SA/EPU/H/1/2/117

SMOKELESS AIR

THE SMOKE ABATEMENT JOURNAL



No. 91 AUTUMN 1954

ONE SHILLING

In this Issue

The Origin of " Smog "
Training Colliery Firemen
The Durban Case
A London Experiment in Smokeless Zones
A New Frontier: Air Pollution Control



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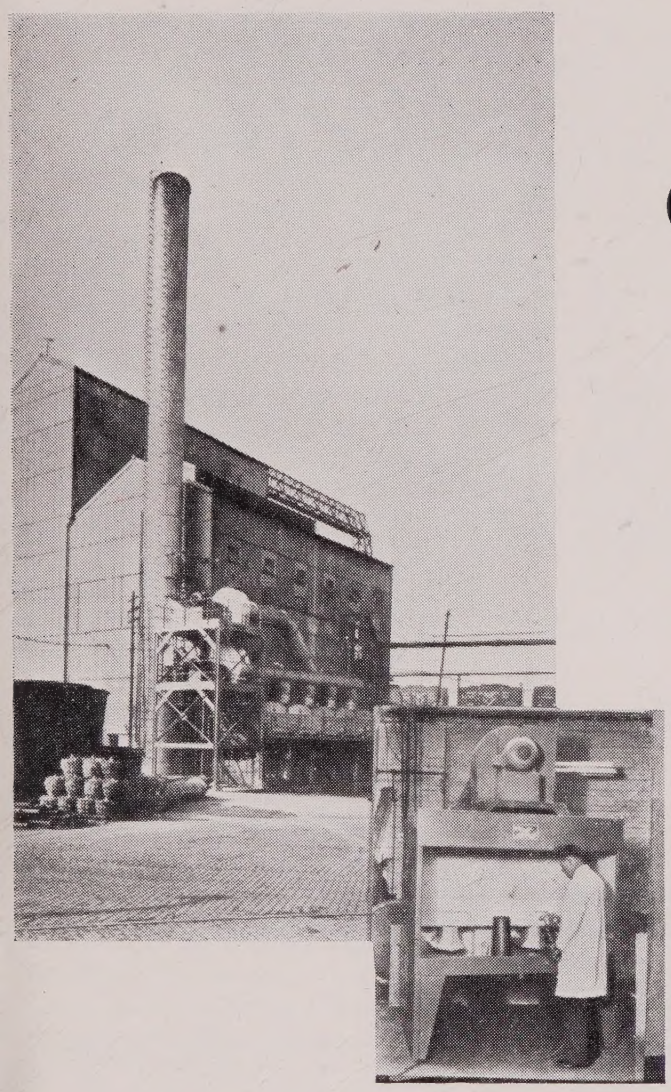
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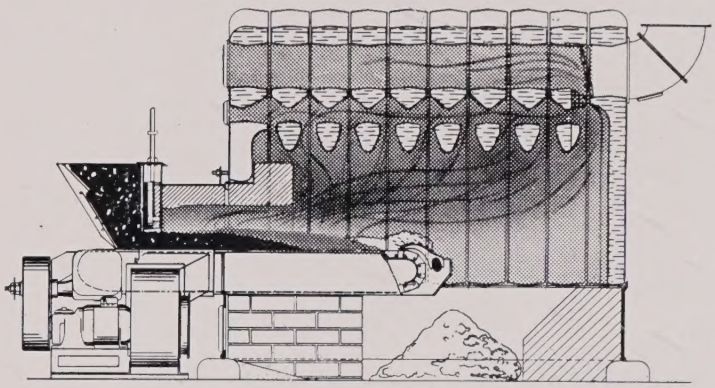
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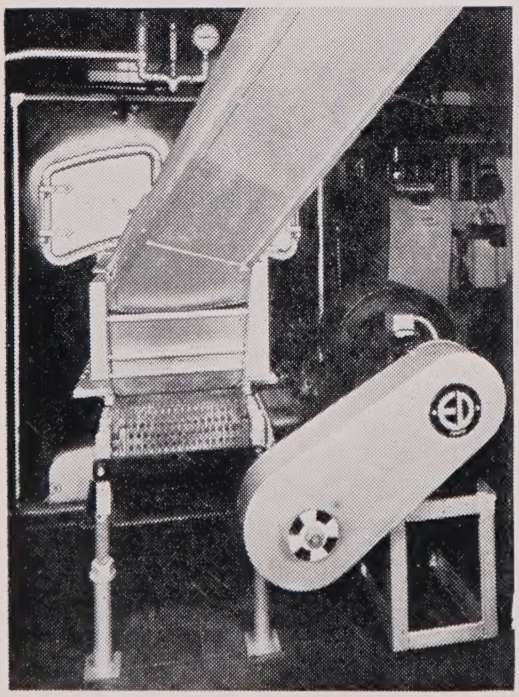
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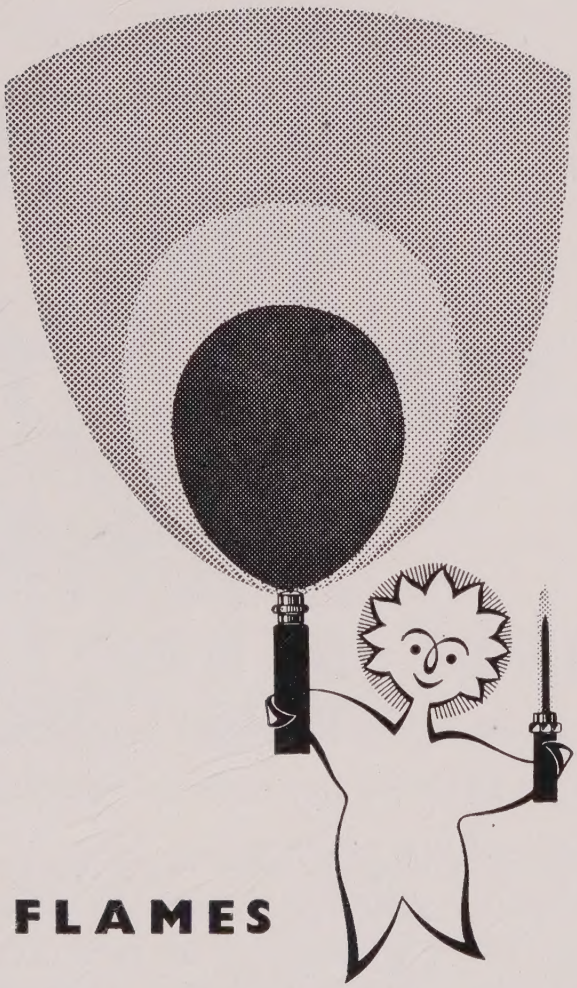
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DOMESTIC SMOKE CAMPAIGN

IN THE WEST RIDING

The biggest concerted campaign so far in this country to deal with the problem of domestic smoke pollution is being launched in the West Riding of Yorkshire this Autumn. Forty-four County and Municipal authorities are concerned, members of the West Riding Regional Smoke Abatement Committee, under whose auspices, jointly with the Yorkshire Smoke Abatement Society, the campaign is being held. The Solid Smokeless Fuels Federation are providing the fullest material support in organising the programme which extends for over a month from the middle of September.

PROGRAMME OF EVENTS

Mon., Sept. 13	EXHIBITION : WAKEFIELD	Northgate Car Park
Mon., Sept. 13	*MEETING : WAKEFIELD*	*3 p.m, Music Saloon, Institute Buildings, Wood St.*
Mon., Sept. 13	*MEETING : WAKEFIELD*	*7 p.m. Music Saloon, Institute Buildings, Wood St.*
Tues., Sept. 14	EXHIBITION : WAKEFIELD	Northgate Car Park
Tues., Sept. 14	*MEETING : LEEDS—OPENING OF CAMPAIGN—Invitation only*	
Wed., Sept. 15	*MEETING : DEWSBURY*	*7.30 p.m. Mayor's Reception Room, Town Hall*
Thurs., Sept. 16	EXHIBITION : DEWSBURY	Market Place
Sat., Sept. 18	EXHIBITION : HUDDERSFIELD	St. George's Square
Mon., Sept. 20	*MEETING : HALIFAX*	*7.30 p.m. Large Committee Room, Town Hall*
Tues., Sept. 21	EXHIBITION : HALIFAX	Corporation Street Car Park
Tues., Sept. 28	*MEETING : BRADFORD*	*2.30 p.m. Mechanic's Institute, Bridge Street*
Tues., Sept. 28	EXHIBITION : BRADFORD	Broadway Car Park
Thurs., Sept. 30	EXHIBITION : LEEDS	Front of Town Hall
Fri., Oct. 1	EXHIBITION : LEEDS	Front of Town Hall
Sat., Oct. 2	EXHIBITION : LEEDS	Front of Town Hall
Tues., Oct. 5	EXHIBITION : MORLEY	Thirlemere Drive, Tingley Housing Estate
Fri., Oct. 8	EXHIBITION : OSSETT	Town Hall Car Park
Sat., Oct. 9	EXHIBITION : PONTEFRACT	Bridge Street
Tues., Oct. 12	*MEETING : CASTLEFORD*	*7.30 p.m. Festival Hall, Florence Street*
Tues., Oct. 12	EXHIBITION : CASTLEFORD	Wesley Street
Wed., Oct. 13	EXHIBITION : CASTLEFORD	Airedale Council Estate
Thurs., Oct. 14	EXHIBITION : BATLEY	By the Library
Sat., Oct. 16	EXHIBITION : BARNSLEY	Town Hall Car Park

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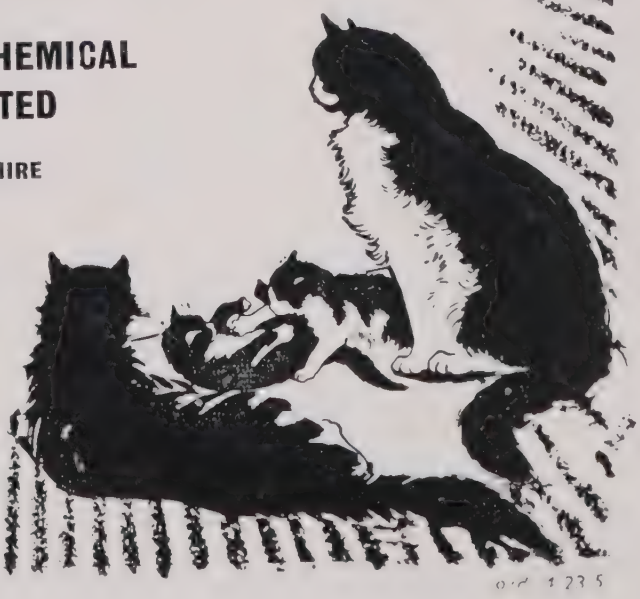
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SMOKELESS AIR

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MEMBERSHIP of the Society is invited and is open to individuals, local authorities, firms and other corporate bodies. Full details and membership application form will be sent on request.

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Ships, towers, domes, theatres and temples lie
Open unto the fields, and to the sky;
All bright and glittering in the smokeless air.

London Skyline

SMOKELESS AIR

An Editorial Problem

WHEN this journal began its life it was easy to deal, once every three months, with all that was happening in the field of air pollution. Today the position is very different and it is increasingly difficult to cover all the news and to mention all the papers and reports. Something of interest or importance seems to happen always just as we go to press, and three months later it is either outdated or in danger of being pushed out by something else. We would like to see *Smokeless Air* become a monthly, but it is impossible for this to be contemplated until there can be both more editorial staff and more advertising revenue to help to cover the increased cost of publication. It has been suggested that as an interim development the Society might issue, either at monthly intervals or as occasion demanded, a duplicated news bulletin or digest, so that members and other readers could be kept up-to-date on all that was happening. The idea of such a service is attractive, especially if it were understood that the bulletin would not be of a fixed size—it might at times, for example, be a single sheet with just one important item—and if (again because of cost and a small staff that already has its hands full) it was sent only to those who asked for it. We would be glad to have the comments of readers on this suggestion, particularly from those who might like to be on the mailing list—if there were one.

P E P and Smoke

Political and Economic Planning (P.E.P. for short), has earned for itself a distinctive position as an independent study and research organization by virtue of the high standards and degree of objectivity it has achieved in its many reports and broadsheets, covering as they do a wide variety of political (in the non-partisan sense), economic, technical and social questions. It is therefore excellent and heartening that they should have decided that air pollution was a subject deserving their attention, and in their latest broadsheet *The Menace of Air Pollution* should have come out strongly, in effect, as a new ally of the Society and its friends. The report, although it had had to be kept within the broadsheet limits, surveys the problem in an admirably concise and yet comprehensive way. It must have been a little difficult for the authors to discuss a policy for the prevention of air pollution in view of the fact a Government committee is expected to report shortly on their much more exhaustive study of the problem, and the broadsheet admits that is would be " unrewarding " to attempt to do so. They consider, however, that the main needs are obvious, and proceed to give an outline of what is required. Acknowledgment is made in the broadsheet to the value of the Society's reports and other publications, and certainly the sort of policy envisaged by P.E.P. is broadly in harmony with the Society's policy as expressed in the recent Memorandum to the Beaver Committee. Elsewhere, too, there are references to the Society, and the comment is truly made that it is evident that we receive much more moral than financial support.

A Smoke Tax?

In one detail of importance P.E.P. goes further than the Society has done. In our Memorandum it was said that " bearing in mind the heavy social cost of smoke there is a strong case for incentives (including that of quality) to popularize its (smokeless fuel) use in place of raw coal ". The broadsheet more definitely argues that if a practice causes costs or losses to the community those responsible should be encouraged to desist from it by some form of tax or penalty. With raw coal that is used with smoke emission (as in the home), the price of coal, it is suggested should be increased by a " smoke tax ", similar in effect to purchase tax, for the purpose of promoting the use of smokeless forms of fuel and power. This, in various ways, has been advocated before, but public opinion has not been thought to be ready to accept it. Perhaps the time is now ripe to discuss it, and although there would no doubt be difficulties in working out and applying the idea in practice it does seem to have a logical and reasonable basis.

Copies of the broadsheet may be obtained from P.E.P. at 16 Queen Anne's Gate, London, S.W.1 (or from the N.S.A.S.) at 2s. each.

Comment on the Memorandum

The Society's Memorandum to the Beaver Committee was given a good Press on publication. Over eighty papers and periodicals reported it —which has been useful in keeping the publicity pot simmering—and there have been a number of approving comments on both the Society and its views. *Power and Works Engineering*, for example, in a leading article on the Memorandum, said : " *The energetic activities of the National Smoke Abatement Society have, for a good many years, kept the subject of air pollution well in the mind of the British public. The Society, more than any other agency, has succeeded in giving the matter a sense of urgency —indeed, has made it a question of the social conscience.*"

We hope also that the concluding paragraph of an excellent annotation in the *Lancet* may be noted by those

who may be able to do something about it: "*The Society, in their steady education of the public in this matter, have done good work and done it on a very small budget. They are fully justified in suggesting that they deserve a Government grant towards it, for no agency is better placed for creating the informed public opinion which alone can lift the cloud from us.*"

Heating Our Offices

A note about the heating problems in the Society's new offices at 30 Grosvenor Place may not be without interest. There are two large rooms on the ground floor, and on the second floor a large and a small room. All the rooms are lofty, which adds considerably to the volume of air to be warmed. Central heating of any kind had to be ruled out and it was soon found that no single appliance is enough to warm the larger rooms adequately in cold weather. There is one hearth and flue in each of the two ground floor rooms, and in these "Cozy" stoves, burning solid smokeless fuel, have been installed, and now a number of "Thermodare" electric storage heaters have been fitted. These heaters use current only during the night hours, storing the heat and giving it out gradually throughout the day. Equipped with thermostats and time-switches, they are given a special night tariff of 1d. per unit, compared with the 1.75d. commercial daytime charge for the area. It is proposed to use these in conjunction with the stoves, experimenting to determine the most satisfactory and economical practice.

For the smaller room upstairs one of the latest gas fires—the Radiation New World Silent Beam "Tewkesbury"—is all that is required, and for the larger room there is a larger model of the same fire—the "Malmesbury" with, on the other side of the room, a "Hurseal" oil-filled electric radiator. There is also a basement room used for storage and odd jobs, for which heating will be required only occasionally and for short periods, and here one of the new portable oil-burning heaters is to be used.

It will be seen that, partly by necessity and partly by intent, the Society is making use of all the smokeless mediums it advocates—gas, electricity, solid smokeless fuel and oil. All the methods are familiar, with the exception of the electric storage heaters, about which we hope to report more fully later on. They are of particular interest because they offer a use of electricity for space heating that overcomes the difficult peak load problem, and their development (there are two makes on the market, Thermodare and G.E.C.) will be of value to the electricity authorities and the consumer. Their use for domestic purposes is at present prevented because of purchase tax restrictions—which seems a short-sighted policy.

The Medical Report

The Ministry of Health's medical report on "Mortality and Morbidity during the London Fog of December 1952" (H.M.S.O. 2s. 6d. net) has been published just as we go to press (an apt example of what was being discussed in the first paragraph above!) and a full review must await our next issue. The report is important because of the definitive statistical information that it assembles rather than for any new light it sheds on the disaster. It has, however, been received in many quarters with a feeling of disappointment, largely perhaps because its meticulously careful and narrow approach and conclusions create, as one newspaper put it, "a distinct flavour of complacency." Thus in a statement that has been widely quoted and which will be long remembered, the report says: "For the great majority of normal, healthy individuals the fog was little more than a nuisance." On this the *Sunday Times* commented shortly: "Nonsense: it was horrible."

The Origin of "Smog"

The Problem in 1905

THE power of a word is incalculable. The blessed word "smog" leaped into the headlines after the great London smog of 1952 and seems, at last, to have come to stay. It has aroused criticism, in the correspondence columns of the *Times* and elsewhere, on the grounds that it is unnecessary, ugly and American. The comedians have cracked jokes about it, and in the popular press a smoke abatement expert tends to become a smog-man, while to make smoke or to be indifferent about it threatens to become the dire new crime of smoggery.

It is, as you wish, all very amusing, trivial or silly ; but all the same it is useful. It captures the attention of the man in the street, irritates some, and has novelty and pep that prosaic "smoke" does not possess. In short, a good publicity word.

It may be ugly, but it describes an ugly thing. Meaning simply smoke plus fog, it is easier and sharper than the compound smoke-fog, and describes a condition quite different from plain clean fog. So it has good linguistic reasons for its existence.

The third criticism, that it is one more dreadful example of American slang, is just not true. The word was coined by the Society's first President, Dr. Harold Des Vœux, in the days when he was the hon. Treasurer and chief spokesman of the old Coal Smoke Abatement Society and the Society was fighting hard even to secure recognition of the fact that there was a smoke problem. One of the Society's press cutting books tells the whole story. Look at the headline of the *Daily Express* for 26th July, 1905 :

"SMOG"
New Name Coined for
London's Fog
Compound

and the first part of the report that follows :

"If the Public Health Congress has accomplished nothing else it has coined a new word for the London fog. Hereafter that peculiarly London institution will be known as 'Smog', a compound of smoke and fog.

"The new word was coined at yesterday's meeting of the congress by Dr. H. A. Des Vœux, of the Coal Smoke Abatement Society".

The *Daily News* headline was :

"SMOGGY" NOVEMBER !
Why London Suffers

and on 27th July the *Globe* had the following erudite comment :

"The other day at a meeting of the Public Health Congress Dr. Des Vœux did a public service in coining a new word for the London fog, which was referred to as 'smog' a compound of smoke and fog. There is a peculiar fascination about the portmanteau word, which will always be associated with the name of Lewis Carroll, and it is remarkable how neatly he used to express what he meant by combining two words. Most of the awe-inspiring adjectives in 'Jabberwocky' are compound words, as, for instance, 'slithy', a blend of 'lithe' and 'slippery'."

It is this paragraph that earned the new word an honoured place in the New English Dictionary—the Oxford Dictionary—where it is to be found in the supplementary volume, beginning thus :

> **Smog.** ('Portmanteau' word f. SM(OKE) *sb.*+F(OG) *sb*[2]).
> Smoky fog. 1905. *Globe* 27th July 3. The other day at a meeting of the Public Health Congress Dr. Des Vœux did a public service . . . . etc.

So far, all seems clear, but there is evidence that Dr. Des Vœux used the word publicly some time before July,

1905, for among the cuttings is one from the *Church Family Newspaper*, dated 20th January, 1905, in which is recorded a long and most interesting interview with Dr. Des Vœux, beginning : " Dr. H. A. Des Vœux, the treasurer and one of the founders of the Coal Smoke Abatement Society, has recently come before the public with a new word, which will doubtless find its way into the English language, for up to now we have had no word to express the particular phenomenon in which he is interested . . .Dr. Des Vœux's new word is ' smog '."

It would seem that the doctor first used the word sometime in 1904, but that it did not attract general attention until it gained wide publicity at the July meeting of the following year.

Crossing the Atlantic

What is practically certain was the first use of the word in the U.S.A. was a report in the *New York Herald* of 30th July, 1905, which began :

" London, Saturday.—Strange to say, while some of the lowlands and the Channel have been dense with fog most of the week, London has seen nothing of its particular plague. Hereafter it would seem that the ' London particular ' is to be known by a new name, that new name having been coined at the Public Health Congress this week, where Dr. Des Vœux lectured on coal smoke abatement, and coined amid applause the new word ' smog ', which is a compound of the two words, smoke and fog."

Other points from the Congress reported in this dispatch can briefly be indicated by the headlines used :

Physician Suggests Use of Tube Railways for Fresh Blasts in City's Centre

and—watch the commas—

Metropolis, Chest Doctor Contends, Owing to Smog, is Unfit as a Dwelling Place

(The physician or chest doctor referred to here was Dr. T. Glover Lyon, of the City of London Hospital for Diseases of the Chest.)

A Mild Resolution

With all respect to the Public Health Congress, the resolution it passed might have been a little more forceful. It ran : " This Congress, being impressed with the importance of clearing the atmosphere of towns from smoke, urges on His Majesty's Government and local authorities the advisability of further efforts being made to attain this object ".

This, one feels, was not drafted by Dr. Des Vœux or the Coal Smoke Abatement Society, which was then forcefully pushing the local authorities into action. In 1903, for instance, as Dr. Des Vœux told the *Church Family Newspaper* reporter, the Society's own inspector had reported 2,000 observations of pollution in London, which led to the addressing of 1,278 complaints to the various local authorities. As a result forty summonses were issued. West Ham appears to have been particularly difficult to move, for, said Dr. Des Vœux, " we addressed no less than 572 complaints to the Corporation before we could induce it to institute a prosecution in a single case ".

The local authorities were waking up to a recognition of their duties, he went on, and smoke inspectors had been appointed in the City of London, Lambeth, Southwark and Westminster. " The Borough Councils are gradually coming round to our point of view, and we do not despair even of the Local Government Board, whose attitude in the past has been somewhat apathetic."

Asked if the Society was well supported by the public, Dr. Des Vœux replied: " No, it is very difficult to get people to subscribe to it, notwithstanding that every person is individually interested in this question of smoke abatement. We recently sent out 10,000 circulars, at a cost of £10, and we got back £4. People begrudge the 5s. a year that it would cost them to help in abating what is, by universal acknowledgment a terrible and costly nuisance."

Plus ça change, plus c'est la même chose . . . .

News from the Divisions

With seven Divisional Councils in being and very much alive, and an eighth about to be formed, it is becoming more difficult to make sure of covering all their activities adequately —reporters for Divisional news would be useful—and we are hoping that nothing of importance has been missed from this account of recent meetings.

SCOTLAND

The two day annual conference of the Scottish Division was held in Kirkcaldy on 27th and 28th May. Mr. John Innes, who is Chief Sanitary Inspector for Paisley, was elected President in succession to the late Bailie J. H. P. Taylor, and Bailie Monteith of Glasgow was elected as the new Vice-President.

At the first morning session of the conference, following a civic welcome, papers were read by W. R. L. Kent of Kelvin and Hughes (Industrial) Ltd., on "The Influence of Instruments on Smoke Prevention and the Efficient Use of Fuel", and by John Duguid, of Laidlaw Drew and Co. Ltd., on "The Contribution of Oil Burning to Smoke Abatement".

Mr. Kent, describing the instruments needed in a boilerhouse, pointed out that if a boilerman did not understand the essentials of his job it did not matter how many instruments he had. Mr. Kent showed in tabular form the cost of smoke to the user according to its density, thus :

	per ton
Light grey	4d.
Dark grey	1s. 2d.
Very dark grey ..	2s. 10d.
Black	5s. 10d.
Dense black	10s. 1d.

A weekly fuel bill of £80, he said, could involve a wastage of £35.

In the afternoon members of the conference journeyed by coach to Glenrothes New Town, where the new Community Hall and the boiler house of the district heating plant—serving one neighbourhood—were inspected. The party then went on to Cupar, where in the County Hall afternoon tea was hospitably provided by the Fife County Council.

In the evening an inspection was made of Kirkcaldy's interesting new Town House, the interior of which is designed and decorated most successfully in the modern style. The designs and plans for Kirkcaldy's proposed multi-story flats were inspected and explained by Mr. R. Meldrum, the Borough Engineer, who described the type of heating to be used. After other types of heating had been considered and rejected, and wishing to ensure that the flats were smoke-free, the Council had decided, said Mr. Meldrum, on an electric floor-heating system, in which the heating elements, like an electric blanket, are embedded in the concrete flooring.

On the Friday morning a paper was read on behalf of James Edward, M.B.E., by his colleague Robert Horn, of N.I.F.E.S., on "Smoke Abatement in Smaller Metallurgical Furnaces", and this was followed by an address and film on "Steam Utilization and Smoke Abatement", presented by Dr. F. Johnson, of the Nobel Division, Imperial Chemical Industries.

At a concluding lunch, at which representatives of the Kirkcaldy Council were guests, the President, Mr. Innes congratulated Kirkcaldy Town Council, its officials and the local industrialists, on the obvious efforts they were all making to abate the smoke. He was followed by Mr. Arnold Marsh, Director of the Society, who gave a progress report. He referred in particular to the memorandum the Society had prepared and submitted to the Beaver Committee, and to the remarkable upsurge of public interest in their

problem. He urged the members present to make full use of this opportunity and to go ahead with enthusiasm to put smoke prevention well and truly on the map.

NORTH WEST

The North West Divisional Council held a meeting at Blackburn on 21st January, which was opened by the Mayor, Councillor R. Weir, J.P. After the business meeting there was an open discussion on local Consultative Committees, with particular reference to the possible formation of one in Blackburn. Dr. Burnett, in the Chair, said the Division would be glad to give any assistance, and representatives from Widnes and Burnley who were present spoke on the experiences and work of the Consultative Committees in their respective towns. The meeting undoubtedly helped towards the formation of a Blackburn committee, and was complimented by the Chairman of the Health Committee. Dr. Thierens Medical Officer of Health, said he was wholeheartedly in favour and would arrange to call the first meeting.

The annual general meeting of the Division was held in Manchester on 27th May. Dr. Burnett announced that he did not wish to continue in the office of Chairman, and the former Vice-Chairman, H. V. Cass, Chief Sanitary Inspector for Oldham, was elected in his place, with Sidney N. Duguid as Vice-Chairman.

Following the business meeting and adoption of the annual report the meeting heard a paper by S. G. Deavin, Secretary of the North Western Gas Board, on " Gas Coke ".

Mr. Deavin refuted allegations that the high cost of coke, compared with the price of domestic coal, was a handicap to smoke abatement. He reviewed the chain of events which had contributed towards the upward



Members of the Scottish Division during the inspection of the district heating boiler plant at Glenrothes, Fife

trend of coke prices and presented figures to substantiate his belief that coke, burned in a proper appliance, is a more economic household fuel than coal.

Many people regarded coke as a waste product—something which happened in the carbonization of coal and which ought to be got rid of for as much as could be obtained for it. The term " residual " had stuck to coke for over a century and many people still regarded it in this way. The man-in-the-street did not refer to petrol as crude oil with the goodness taken out of it. " Both coke and petrol are refined products in their own right ", declared Mr. Deavin. " Wherever proper appliances are available coke can be burnt with greater efficiency than coal, which means that if one hundredweight of coke costs the same as one hundredweight of coal, then one hour's heating by coke is cheaper than one hour's heating by coal ".

Since 1949 the North Western Gas Board had spent £3 million on modern plant to improve the quality of coke offered to consumers in its area. The Board had set itself to concentrate on endeavouring by increased efficiency to reduce the cost of distribution of consumer services and administration. Its aim was to cut these costs and get down the price of both gas and coke.

The Scandinavian countries now wanted the North Western Board's large coke above all others in the country because of its superior quality. What they could do in the export market they could certainly do in the home market. The Board was aiming, in consultation with merchant distributors, at the formation and the building up of a coke marketing scheme directed solely to improving the quality and services given in this refined smokeless fuel.

YORKSHIRE

The Hon. Secretary of the Yorkshire Division, Mr. James Goodfellow, spoke at a meeting of the Leeds and District branch of the Electrical Association for Women recently, and was also one of the speakers at a meeting in Wakefield sponsored by the Solid Smokeless Fuels Federation. At the latter meeting he stated that the Leeds Health Committee was campaigning for the building of a new estate which would be a smokeless zone from the start, by making the use of smokeless fuel a condition of tenancy.

On 12th July the Divisional Council visited the new gasworks at Tingley near Wakefield, as guests of the North Eastern Gas Board. The total cost of new work at Tingley will amount to £3 millions. The present daily output of 7 million cu. feet of gas will be doubled for compression into the grid system.

Mr. H. Johnston, Chief Engineer to the Gas Board, explained that apart from the increasing demand for gas, the main reason for the extension was to substitute for loss of gas as a result of the closing of smaller works, which would lead to more economic production and distribution.

Mr. Norman Hudson, Chief Commercial Officer to the Board, referred to the new coke marketing scheme due to start in October which would enable people residing in remote parts of the country to obtain supplies of coke for domestic fires. The Board would undertake to deliver coke to the nearest railway stations and the country dweller would pay only the same price as consumers living in a town with a gasworks.

A joint meeting of the Divisional Council and the West Riding of Yorkshire Regional Smoke Abatement Committee was held in Leeds on 15th July, and was addressed by A. G. Ludgater, Technical Manager of the Solid Smokeless Fuels Federation, who gave an illustrated address on " Smokeless Zones and Solid Smokeless Fuels ". Mr. Ludgater announced a campaign which will be launched in the West Riding in September by his Federation. Their mobile exhibition will visit all the main towns in the area during the campaign, which will last two months.

(Arrangements have been made by the Federation for the mobile exhibition to be in Scarborough during the period of the Society's conference. Details are given in the conference programme.—*Ed.*)

EAST MIDLANDS

The members of the Division met at Loughborough on 25th March and visited the Engineering Workshops of the Loughborough College of Technology, by arrangement with the Principal, Dr. H. L. Haslegrave. After lunch the fifty-three members present were welcomed by the Mayor of Loughborough, Alderman Dennis Smalley, and an address was given by Graham Oldham of the Department of Pure and Applied Science at the College on "The Role of Sulphur Dioxide in Atmospheric Pollution".

On 8th July the Division held its annual general meeting at Belper, Derbyshire. Mr. T. Henry Turner was elected Chairman, and Mr. Alderman S. Cooper, of Leicester, Vice-Chairman. In the morning a tour was made of the works of Park Foundry (Belper) Ltd., a Radiation company, where domestic appliances are manufactured. After lunch, by invitation of the Directors of the company, the meeting was welcomed by the Chairman of the Belper Urban District Council, Councillor Mrs. M. Barker, J.P., and Dr. W. Davidson, of Radiation Ltd., gave an address on the subject of "Smoke Abatement and Domestic Appliances". Dr. Davidson described the various appliances made by the foundry for increased efficiency and reduced smoke, and gave figures to show the differences between the efficiences of the open fire, the closed stove, and central heating.

WEST MIDLANDS

An interesting meeting was held by the West Midlands Division at the Botanical Gardens, Birmingham, on 28th April, when an address was given by Dr. P. F. Wareing of the Department of Botany, University of Manchester, on "Air Pollution and Plant Growth". The lecture, which was illustrated by slides, was followed by a discussion opened by S. Pitman of the Birmingham Parks Department.

SOUTH EAST

The first regular meeting of the new South East Division was held at the Royal Sanitary Institute on 10th June, when about 60 members were present. An address on "The Local Authority and Air Pollution" was given by H. G. Clinch, M.B.E., who was followed by A. Ellis Holt, Sales Manager of Radiovisor Parent Ltd. deputising for G. A. G. Ive, Technical Director of the company. Mr. Holt gave a very informative talk on "Electrical Photocell Smoke Density Equipment", followed by a demonstration of the apparatus itself. There were questions and discussion on both addresses before the close of the meeting.

The annual general meeting of the Division was held in the Caxton Hall, Westminster, on 15th July, and again was well attended. Dr. Andrew Shinnie, who had agreed to act as Chairman during the inaugural period, did not wish to be renominated for this office, and Alderman C. H. Smith, O.B.E., of Wembley, was elected. Dr. Shinnie agreed to act as Deputy Chairman, and J. J. Matthews was re-elected Hon. Secretary.

The business meeting was followed by an address by G. E. Hall, Technical Officer to the British Coking Industry Association, on "Solid Smokeless Fuel and Smokeless Zones". This was followed by a number of questions and discussion.

REGIONAL COMMITTEE ACTIVITIES

The meeting of the West Riding of Yorkshire Regional Smoke Abatement Committee held jointly with the Yorkshire Division of the Society, mentioned above, was preceded by the annual general meeting at which E. J. Winfield, Chief Sanitary In-

spector, Castleford U.D.C. was re-elected Chairman, and Dr. I. G. Davies, Medical Officer of Health, Leeds, was re-elected Hon. Secretary.

Minutes have been received of the various meetings of the Tees-side Smoke Abatement Committee, which is maintaining a high level of useful activity in its area, including the co-ordinated organization of the measurement of pollution. At a recent meeting a statement about the availability and distribution of gas coke in the area from the Northern Gas Board was read, and it was resolved that the Board be asked to keep the Committee informed on the consumption of coke.

SMOKE AND CANCER

The Annual Report, for 1953, of the British Empire Cancer Campaign, contains several important references to work being done in connection with the factor of air pollution in relation to cancer of the lung. The reports of the Department of Pathology, St. Bartholomew's Hospital and by Dr. Percy Stocks on the work being done in the Merseyside and North Wales region are of particular interest. They can best be reported by quoting, from the general summary that precedes the separate reports, the section headed " Environmental Cancer ", as follows (our italics) :—

" The investigation of the past histories of persons suffering from different forms of malignant neoplasm, with respect to residence, occupation, diet and tobacco, during the 20 years before the onset of symptoms, which was initiated in 1952 by the Cheshire and North Wales Branch of the Campaign, was continued during the year. Special attention has been devoted to such questions as the basis of diagnosis, the comparative mortality in the North Wales and the Liverpool hospital region, soil analysis in connection with cancer, and the possible connections between lung cancer, tobacco, and atmospheric pollution. The accumulation of evidence for an association between smoking and bronchogenic cancer, and experimental indications that tobacco tar has carcinogenic properties, make it very desirable to discover to what extent exposure to other forms of smoke in towns is a significant factor, either alone or in conjunction with tobacco smoking. *It appears that, important as differences in smoking habits may be, they do not go far towards accounting for the observed pattern of death rates in the region, which would seem to be related to housing densities and the smoke drift from industry.*

" Further progress is reported in a comprehensive study of the amounts of carbon in human lungs and bronchial glands, in relation to lung cancer, of the statistics of cancer of the lung in town and country, and of atmospheric pollution. The last includes a specially interesting comparative survey of atmospheric pollution in Iceland, representing part of an inquiry into the relations of such pollution and of smoking habits to the incidence of bronchial carcinoma in England, Iceland, Norway and Denmark."

The report referred to in the above paragraph discusses in more detail the question of cancer of the lung and larynx in town and country and summarizes a paper to be published shortly (Curwen, Kennaway and Kennaway). This states : " In the case of cancer of the male lung we have had sufficient number of deaths to show that the mortality in the Rural Districts of 11 regions of England and Wales (i.e., omitting Greater London) is positively correlated with the number of persons per acre ". Further, the urbanization gradient is distinctly steeper in men than in women.



Below the surface . . .



. . . and above

—By kind permission of Vicky and the Daily Mirror

More Statements to the Beaver Committee

The Royal Sanitary Institute and the Sanitary Inspectors' Association have published memoranda they have submitted to the Beaver Committee. The R.S.I. statement consists of concise answers to some questions put to them by the Committee, mainly on the law and its administration. The main points made by the Institute are that a national standard of smoke nuisance should be established and that prior approval should be permissive. The nuisance limit should be 3 minutes in 30 with Ringlemann shade No. 3 as the maximum. Certain special cases should come under the Alkali inspectorate. In the " black " areas smoke inspection should be undertaken by full-time qualified smoke inspectors, but elsewhere smoke inspection might be combined with other duties.

The S.I.A. memorandum is a longer document, also mainly concerned with legislation. They propose a standard of emission with Ringlemann shade No. 2 as the maximum. An important point of detail to which reference is made is that there should be control of pollution which is not discharged from chimneys. It should be obligatory for stokers to have a direct or indirect view from the firing floor to the chimney top, and for an audible alarm and smoke recording instruments to be compulsory, at least on all large plant. Domestic smoke proposals are similar to those made by the N.S.A.S., and also " the whole of the legislation relating to air pollution in all its forms, including smoke, grit, dust and fumes, should be revised, clarified and consolidated into one comprehensive Act ".

" Sanitary inspectors ", states the memorandum, " are the appropriate officers to administer the legislation, but greater attention to the subject of air pollution should be given in the basic examination ; the additional qualification at a markedly higher level should be continued ", and " where there is sufficient work to justify it, sanitary inspectors should be engaged full-time on anti-pollution work, otherwise it should form part of their general duties ".

Prior approval of the kind embodied in recent Acts, and national standards for the design, construction and performance of fuel-burning apparatus in industry, is advocated by the Association, which also urges that powers to create smokeless zones should be included in the new general legislation.

The Association also emphasizes the criticism of the present law that has been made by the N.S.A.S. " The Public Health Act does not give local authorities sufficient power to secure a general reduction of the level of pollution, as its provisions are only punitive and designed to deal with specific nuisances created by individual installations and chimneys. The Act contains no positive provisions for the prevention of pollution."

Officials of the Dublin Corporation are working on a scheme for setting up a ring of measurement stations around the city which will gauge the intensity and drift of atmospheric pollution. Although Dublin is less industrialized than London, the impurity of the air has been found to be almost as bad, with three-quarters of the pollution coming from domestic chimneys and only one quarter from factories.

Willesden Council has informed the Central Electricity Authority that it does not consider the plans to prevent smoke pollution by the new Acton Lane generating station will be satisfactory. The C.E.A. had intimated that high efficiency grit collectors will be installed and chimney gases released at a high temperature from 300 ft. chimneys, which will ensure that there is no nuisance either from grit or sulphur dioxide fumes, which will disappear into the upper atmosphere. The Authority states that it does not propose to install gas washing equipment because it considers it to be of doubtful value.

TRAINING COLLIERY BOILERMEN

The N.C.B. Scheme

THE National Coal Board has introduced an important training scheme to give colliery boilermen the opportunity of brushing up and improving their technical knowledge and thus to enable them to obtain the maximum benefit from the new mechanical equipment that is being installed to replace old-fashioned hand-fired plant.

A feature of the course is the way in which theoretical and practical training is combined in a series of studies which allow the student to work at a pace well within his capacities. There tends to be a wide variation in the age, experience and ability of prospective students. Most of them are on shift work, in widely separated collieries, and many of them would not, through limitations in their education, be able to take advantage of courses that are available at technical colleges, even if they were able to attend them.

The Board's scheme enables them to take a course of instruction which improves their knowledge considerably, gives successful students the chance to win the new certificate of competency set up by the City and Guilds of London Institute, and permits them to study in a way that fits in with their normal work.

The training scheme is based on supervised home study conducted through weekly correspondence with the College of Fuel Technology, and a full one-day meeting each month when students gather for discussion of their theoretical work and for practical demonstrations at a boilerhouse under the chairmanship of a trained engineer. The whole work of the course is geared to those monthly meetings. They are the connected points between the correspondence college which sets and checks the students' written work, and the group chairman who is responsible for guiding their studies and supervising their practical training. Visual aids and instructional films are used and a visit to an Area laboratory is included in the syllabus as well as practical work on the boilerhouse floor.

The aim is to train men to be fully competent as to sit for the Boiler Operator's Certificate, which includes a practical test as well as a written paper. During training the group meetings provide the students with a familiar atmosphere in which they can work confidently and against which their progress may be judged. It is therefore necessary to choose the training centre with care.

The Training Centre must have a lecture room big enough for a group of students numbering up to twenty, and, as most of them come from scattered districts and may have to travel some distance, it should also have very good canteen facilities. It is not absolutely necessary to have the boilerhouse in the same place, as a bus can be used for carrying the group to a nearby plant or laboratory according to the lesson being taken.

The Group Organizer. It is necessary to appoint a responsible official to attend to the administrative work entailed in running a course. His duties will include enrolling students, consultation with Area engineering and scientific staffs for the provision of demonstration material, and careful liaison with the chairman, the correspondence college and with managements to ensure that men may be released from work and that meetings are arranged according to a set timetable.

Enrolment has to be completed at least a month before the course starts as there must be time to pre-

pare individual instruction and to group men according to the type of equipment on which they are to train. There are no age limits for prospective students and no fees for them to pay.

Courses take seven months and are arranged in summer and winter periods. The winter period starts in September and the summer session in February, and both end about a month before the student takes his examination. The home study lessons are given over a period of 18 weeks and there are several monthly meetings—no home work being done during the week of the discussion meeting. A trial examination is given to each student before he sits for his certificate.

The Group Chairman has a very important part to play in the training of students and a good deal depends on the successful handling of his first meeting. He is the personal channel through which instructional work is discussed. He is not expected to give lectures but to clear up difficulties that have arisen during home study and give guidance on the lessons to be learnt in the forthcoming month. He receives a monthly report on each student from the correspondence college, which briefs him on points where students are not clear or tend to be weak in their studies. He is thus able to help and encourage individuals and to direct and advise the group as a whole.

The First Meeting. A full day is given to each meeting. This gives the chairman time at the inaugural meeting to meet each student, give the group a full explanation of what the course involves, answer their questions, and allow everyone to become familiar with the programme ahead.

All students are provided with a carton containing their homework lessons for the first month, an instruction book, the Board's "Handbook on Mechanical Stokers for Shell Boilers", drawing instruments, and everything they are likely to need down to pencils and paper.

They are then introduced to the home study syllabus and shown how this work is divided into two parts : the boilerhouse lectures which explain how things work, and the supplementary lectures which give them a simple scientific description of why they work. The instruction book tells them where to find this information, how to prepare weekly lessons, and where to send them. The students are then able to think over what they have been told before they start on their first week of work at home. The rest of the day is devoted to practical training, and the men begin to learn how their home work is interpreted and clarified through the monthly meetings.

It is usual to show a film on the formation of coal and follow it up by a simple scientific demonstration of coal sampling and analysis conducted by an official from the Area Scientists' Branch. After lunch there are further demonstrations and the class starts to become acquainted with instruments and control equipment.

At all the succeeding meetings a further supply of lectures is issued for home study and the chairman reviews the previous month's work and clears up any doubt. He then outlines the work for the coming month, after which there is an open discussion in which students are encouraged to ask questions. The afternoon's work is again in the boilerhouse or laboratory.

The programme is devised so that each subject is broken down into description and demonstration, and everything that the student has learnt at home is entirely covered by this method.

The chairman will take the current topic (which might be boilers, fuels or flue gases), discuss it in the morning and show it by example in the afternoon. Students who have seen a film on how coal was formed in association with other matter can learn what has happened to it in the geological process by observing a coal sampling test. They can discuss the transmission of heat and see it demonstrated with temperature measurements through the working of coking and sprinklet stokers, or

watch an analysis of flue gases in the laboratory and then practise using the instruments which regulate the control of combustion. They should, by the end of the course, have achieved a complete balance between their theoretical and practical studies.

The Trial Examination. The seventh group meeting is given over to a full-dress rehearsal of the City and Guilds examination. Most of the men sitting will be intelligent and willing to learn, but many of them are middle aged and might fail a set examination unless given a careful and sympathetic preparation for it.

The trial examination, which consists of a written paper as well as a practical test, is conducted in similar conditions to those for the certificate, so that it is made as realistic as possible. Board officials act as examiners though they are usually brought in from other Areas to do so.

Finally, the students take their City and Guilds Certificate by which time many of them are equipped to proceed with further training if they wish. Following the first courses arranged by the Board, 107 of the 116 Boiler Operator's Certificates awarded in 1953 by the City and Guilds were gained by N.C.B. Students. 172 N.C.B. men have taken the May, 1954 examination.

New Publications

90th Annual Report on Alkali &c. Works, 1953. By the Chief Inspectors. (H.M.S.O., 2s. 6d.)

It is always difficult to review and summarize this report, largely because of the considerable importance of the numerous questions covered by the " &c " in the title. These include both processes registered under the Act, and unregistered processes to which the Inspectorate are giving their attention. Thus we find a wide variety of problems discussed, ranging from dust from cement production works to smells from pesticide works, from electricity generating stations and gasworks to coke ovens and burning colliery spoilbanks.

The report has some interesting points about cement works : " In the early months of the year there were rainless periods, persistent east and north-east winds and with incidence of local fogs. As a result there have been complaints against cement works in many areas. Nowhere were complaints more bitter or prolonged than on Thames-side, an area where about half the cement in the country is produced . . . the problem here is possibly the most intractable one facing this Department ; it may to some extent be regarded as an insoluble one. Especially is this the case while the national call for cement is such as to necessitate the operation of kilns at full rated output even during periods when dust arrestment plants are faulty or undergoing repairs. Climatic conditions in the Thames-side area in the early months of the year were such that in any case complaint was almost inevitable and was made absolute by the circumstance that give out of the 23 electrical precipitators 5 were out of action for repairs, four of them being in one works." It is agreed that " the life of an electrical precipitator dealing with wet cement kiln gases is relatively short ".

The inspection and testing of the flue gas washing process at the Battersea power station is reported. In 1953, 823,000 tons of coal were burned at the station ; 52 per cent of the total flue gases were washed, and on the average 21.7 per cent of the total sulphur escaped to the atmosphere, giving a figure for the overall removal of sulphur oxides of 40.7 per cent. This means that out of 7,760 tons of sulphur in the coal burned, 4,540 tons escaped, the remainder being retained in the ash and by the washing processes. The flue gas washing plant at Bankside B was also inspected and tests made. The sulphur content of the oil burned was 3.6 per cent and the estimated efficiency of the washing process was 97.5 per cent, 120 to 130 tons of washing water are used for each ton of oil burned. From the 23,430 tons of oil used in the period (July to December, 1953), 822 tons of sulphur were retained by the washer and 21 tons escaped.

Burning spoilbanks are discussed at

some length. The overall position shows little change, and it is noted that out of 473 spoilbanks, 246 are in a " Class A", condition—no smoke or fumes ; 204 are emitting slight smoke or fume, and 23 much smoke or fume.

Fuel Research, 1953. Report of the Fuel Research Board, with the Report of the Director of Fuel Research, for 1953. (H.M.S.O., 2s. 6d.)

This report is also full of material of importance to those concerned with the prevention of air pollution. The report stresses how the year 1953 was marked by increased public attention to one of the effects of the inefficient use of fuel, namely, the production of smoke and other substances causing air pollution, and how closely much of the work of the Fuel Research organization is linked to this aspect of fuel economy.

Details are given of progress during the year towards perfecting the method of washing flue gas with ammonia to remove sulphur compounds and recover ammonium sulphate and sulphur. It is shown how basic investigations of the vapour pressures of the ammonia-water-sulphur dioxide system have helped this work.

Improved equipment has been developed for recording the amount of smoke passing up domestic chimneys and a start has been made on a more intensive investigation than hitherto on the factors affecting production of smoke from open fires. At the same time work has been re-started on the manufacture of coke that will be easier to burn than present day gas coke, using typical gasworks equipment but modified conditions of carbonization. Cokes which burn satisfactorily on an ordinary domestic grate have been produced in this way from a weakly-caking Nottinghamshire coal.

Fuel for the Nation. (The Gas Council ; 1s.)

This is a most informative illustrated handbook on the gas industry, which surveys both progress made in recent years and the industry's programme of development in the immediate future.

The demand for gas, which rose by 8 per cent during the three years to 31st March, 1953, is expected to increase further as a result of new housing developments and the continually growing use for industrial processes. By 1959-60 total gas consumption is estimated at 2,924 million therms compared with 2,524 million in 1952-3.

To meet these demands, it is estimated that manufacturing capacity must be increased from the 1953 total of 11,189,000 therms a day to 12,795,000 therms. The additional capacity will be provided partly by an increase in carbonization plant and partly by an increase in water gas and other plant ; also, the amount of gas purchased from coke ovens will be increased during the period.

The integration and interlinking of undertakings has been one of the industry's major tasks in recent years, and it is hoped that by 1960 the plans of the Area Gas Boards for such integration will have been almost completed, with a consequent cessation of gasmaking at the smaller, less economic works and a concentration of production in the larger, more efficient units. Already since vesting date production has ceased at 180 small works and supplies of gas have been provided from more economic stations.

City of Pittsburgh, Bureau of Smoke Prevention. Report for 1953.

The United States Weather Bureau credits Pittsburgh with having reduced its smoke of six or eight years ago by over 94 per cent. This outstanding achievement, the new report indicates, is due to three factors : education and propaganda to " arouse the average citizen's interest in smoke abatement ", a new ordinance with the necessary teeth, and the way the ordinance is used. Mr. Sumner B. Ely, the Superintendent of the Bureau, remarks on this in the report :

" Just as important as the ordinance itself was the method used in its application. Smoke inspectors must be able to help and advise the owner of a smoking plant. An inspector is not a policeman but a combustion engineer. Unreasonable enforcement breeds antagonism. Smoke is not stopped in the court room ; it is stopped in the fire box. Convince a man he is losing money up a smoking stack and you don't need enforcement. Very little legal action has been necessary as the records over past years will show."

The recently issued Health Reports for the cities of Manchester and Liverpool, for 1953, contain important sections on smoke prevention which it is hoped to review in our next issue.

The Durban Case

WHAT was described in the local press as the biggest sensation in South African municipal history was caused by the Durban City Council when they requested the Standard-Vacuum Refining Co. to close its £6,000,000 oil refinery. Although an agreement has now been reached the dispute has served to throw into relief the difficulties which atmospheric pollution can cause when industrial development takes place in a residential area.

In January last the Standard-Vacuum refining Company of South Africa opened its new refinery at Durban. Built at a cost of £6,000,000 it is the first oil refinery in the Union and will eventually produce 80 million gallons of petrol (about a fifth of the country's total requirements) annually.

The plant is situated at Wentworth in a residential district of Durban called the Bluff, on land purchased from the Durban City Council which was originally intended for residential development. Adjoining it is a further section scheduled for residential purposes.

Soon after the plant began operations there were complaints from local residents that pollution was making living on the Bluff impossible, preventing people from sleeping, and causing nausea and vomiting. A residents' vigilance committee was formed and the City Council set up a sub-committee to investigate the complaints. Mr. Bryant F. Kennedy, managing director of the company, assured a meeting of Bluff residents and Councillors that the fumes would be eliminated by the end of March by means of additional equipment.

On April 14th, following further complaints, the City Council unanimously passed a resolution, proposed by the vigilance committee, calling on the refinery to close down completely and not to recommence operations until it was certain that there would be no further pollution of the air in the vicinity. The company was given 24 hours in which to comply, failing which a court order would be sought.

Having been informed of the resolution by special messenger, the refinery management immediately asked for an extension of the time limit to enable one of their directors to fly from Cape Town for a board meeting. They also informed the Department of Commerce and Industries of the council's ultimatum. Department officials began to study the situation but refused to comment in the absence of the Minister of Economic Affairs, Mr. Louw, and the secretary of the department. The Press, however, was, as usual, rather less reticent and there was a considerable amount of speculation about the possible effects of the council's action. In general, the opinion seemed to be that closure would have an adverse effect on industrialists contemplating starting big industries in the Union. The possibility that a local authority could shut down a big plant, even temporarily, it was felt, was likely to divert investment from the Union. In addition it was reported that since opening the refinery the company was no longer importing refined petrol ; any sudden stoppage would therefore mean that supplies would be cut off from the marketing organization, which would lead to a stoppage of essential transport and a general dislocation of commercial activity.

In the midst of this alarm an odd note was struck by a newspaper account of the flying difficulties of Mr. J. B. Nolan, a director of Standard Vacuum, from Cape Town to attend the company's emergency board meeting : " He left by this morning's Skymaster and was booked as far as East London, from where he was told the plane would be filled by the 22 Israeli footballers. To get Mr. Nolan

here as fast as possible, the Company had chartered a private plane to bring him up from this point, but later there was a re-arrangement of seats and Mr. Nolan was able to continue in the Skymaster." Hardly less incongruous was an invitation to the company to strike its tents and establish the refinery in the town of Springs, in the Transvaal.

The next day Mr. Louw intervened, calling for a round table conference between representatives of the council, the company and his department ; but the council stated that they " would not budge an inch," and the refinery continued to operate, denying that the air had been polluted and stating that their own employees had suffered no ill-effects. The deadlock continued, with Mr. Louw, mindful of the economic repercussions a close-down of the refinery would have, yet sensitive to the clamour of those guarding the health of Durban residents, still calling for calm discussion and no precipitate action.

Ultimately, a week after the council had issued its ultimatum, the round table conference was held, and the next day agreement was reached. The company agreed to continue efforts to ensure that there was no objectionable effluent and to investigate the possibility of installing additional plant to ensure the absence of smell ; and also that three experts of " world renown ", to be chosen by the government, should establish whether the plant was properly designed and operated and whether any improvements could be made to minimize or prevent the release or escape of objectionable effluent and odours. The company would pay the costs of such an independent investigation, and the council agreed to abide by the findings, except in regard to any danger to health or serious or persistent nuisance.

In the meantime a joint health office has been set up in the city which will be open twenty-four hours a day to investigate all complaints of nuisance.

When the question was raised in the House of Assembly a few weeks later, Mr. Louw replied that the campaign would appear to be not unconnected with the coming provincial elections. In support of this he showed the House a photograph of an election poster for one of the candidates, a member of the Bluff Amenities Committee, which read, " Defend your home. Demand immediate council action against chemical fumes to prevent offensive smells, etc., from the plant." The chairman of the Bluff Amenities Committee, however, told the press that the elections had nothing to do with the Committee, and that the Councillor in question had been co-opted together with other local Councillors who could act as liaison with the Durban City Council.

The names of the panel of independent experts which is to investigate the plant have since been announced. These are Professor O. H. Garner, O.B.E., Dean of the Department of Chemical Engineering at Birmingham University, E. S. Sellers, of the Department of Chemical Engineering at Cambridge University, and H. G. Howson, a retired inspector under the Alkali, etc., Works Act.

A Smoke Abatement Advisory Committee has been set up in Smethwick consisting of Corporation officials, councillors, industrialists, housewives and trade unionists. The purpose of the committee is to make the residents smoke pollution conscious and enlist their cooperation to get rid of smoke and fumes.

The John S. Owens Prize, value 20 guineas, offered annually by the Royal Sanitary Institute, is to be awarded this year for an essay on " Modern Practices in the Conservation of Heat, with special reference to Smokeless Fuel Appliances ". The closing date is 31st December, 1954, and particulars may be had from the Secretary of the Institute at 90 Buckingham Palace Road, London, S.W.1.



From our Photo-Library—20

No Title

This outstanding photograph of domestic smoke was taken by a member, Mr. F. Huntly Woodcock. We invite readers to submit the most telling title for using it in propaganda

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Rochdale's Smokeless Zones

As reported in our last issue the first smokeless zone in Rochdale came into force on 5th July. The fuels authorized to be used in the area are coke and anthracite, Coalite, Phurnacite, hard Welsh Steam coal, and oil ; together with washed singles bituminous coal used with an underfeed stoker and by no other method.

Two further smokeless zones are being discussed, each of about 500 acres. One of these may come into operation next year and the other in 1956. The basis of these two zones will be Corporation housing estates. Although there are open spaces in each of the areas the first encloses, or will enclose, some 4,000 houses.

A scheme for a smokeless zone in the centre of Nottingham has been approved by the Health Committee of the City Council. The Manchester Health Committee has approved schemes for a further extenson of the central smokeless zone. As previously reported, the present zone of 104 acres will be extended from 1st May next by the inclusion of a further 130 acres. The proposed further extension is for an area of 178 acres.

To prevent smoke nuisance from tugboats passing Chelsea the Council is to ask the Port of London Authority to do all it can to encourage tug-owners to burn only smokeless fuels, as they did during the Festival of Britain.

THE SEARCH FOR NATURAL GAS

Smokeless Air was represented on a recent Press visit to Crowborough Warren, in Sussex, where drilling is in progress for natural gas. The visit was arranged by the Gas Council, on whose behalf the prospecting is being done by the D'Arcy Exploration Company, which is a subsidiary of the Anglo-Iranian Oil Company. At lunch, preceding the inspection of the site, Sir Harold Smith, Chairman of the Gas Council, explained why they had decided to spend £1,000,000 over a period of five years on this work.

" There were two main reasons ", he said, " for the Gas Council's decision. On the one hand, the price of our basic raw material—coal—had been increasing so rapidly that it was costing us about 25 million pounds a year more than it would have at prices ruling when the industry was nationalized in 1949. During the past twelve months the price of coal had risen again and we are now faced with an extra annual cost of £30 millions. I must emphasize that this is the extra cost due to increases in price and does not include the cost of additional tonnage."

The other factor was the increasing scarcity of good carbonizing coals. " The gas industry is dependent more than most upon having coal of suitable quality to process, and unfortunately we have every reason to believe that, at the present time, considerable supplies of such coals are being allocated to industries which are unable to convert them into heat with the efficiency of which the gas industry is capable—to say nothing of the question of smoke abatement, on which I do not need to enlarge today."

The work which is necessary in the course of a search for natural gas falls into two categories. First, the preliminary exploration to determine the localities in which natural gas is most likely to be found, and secondly the deep drilling in these localities to establish its presence or absence.



The Derrick at Crowborough Warren

Sir Harold Smith mentioned the survey work now being carried on in Yorkshire and Lincolnshire, and the drilling which had already taken place at Cousland in Midlothian, where natural gas was first found in 1939. Other counties in the south of England and the midlands were scheduled for survey work in the near future.

That natural gas does exist in Sussex, often quite near the surface, has been known for many years. The railway station at Heathfield was lit for years by natural gas, and people have recently recalled the incident of a " burning bog " at Hammerden. At Crowborough, however, it was not expected to find natural gas near the



Joining two of the 30 *foot drill sections*

surface, and the drilling is planned to go down to a depth of 2,000 feet or more.

On the Site

The phototgraphs of the well-head and derrick at Crowborough give some idea of the site. At the time of the visit drilling had reached a depth of 800 feet, and the party was able to see the assembly and descent of the 30 foot drill sections, which are brought up at intervals with a core of rock for examination. Promising traces of gas had been found in the cores extracted the day before. The boring is being made into the dome of a large anticline under the Sussex weald, which covers an area of some 25 by $4\frac{1}{2}$ miles.

If gas were found in abundant quantities it might so benefit the industry that the price of gas could be reduced generally. But it will be rewarding even if only enough is found to provide for a neighbouring town or two. Natural gas is of a higher calorific value than coal gas and its use would involve either the alteration of burners in gas appliances, or reforming it and then mixing with the ordinary supply without alteration of appliances.



The Well Head

From the smoke prevention point of view this exploration is of the greatest interest, as is any enterprise that may lead to the greater availability of smokeless fuel, and we hope it will be possible in due course to report deserved successes coming to the D'Arcy Exploration Company and the Gas Council.

A LONDON EXPERIMENT IN SMOKELESS ZONES

By

M. Lindsay Taylor, LL.B., Town Clerk of Tottenham

In their Parliamentary Bill of 1952, the Corporation included a clause, based on the model clause, enabling them by Order to establish smokeless areas. The clauses duly became Section 47 of the Tottenham Corporation Act, 1952, and the first Smokeless Area Order made by the Corporation was submitted to the Minister of Housing and Local Government and confirmed by him without amendment on the 28th June, 1954. The Order is to come into force on the 7th January, 1955. By another model clause (Section 46 of the Act) any new furnaces for steam raising or manufacturing or trade purposes must (so far as practicable) be capable of being operated continuously without emitting smoke. The intention of the Council is to operate both these powers concurrently.

The Council designedly limited their first Order under the new powers to a small area, selected (as will be seen later) by reason of its redevelopment being imminent, with a view partly to gaining experience for the guidance of the Council in future cases, and partly to draw the attention of the public to what can be done in homes and factories in preventing atmospheric pollution.

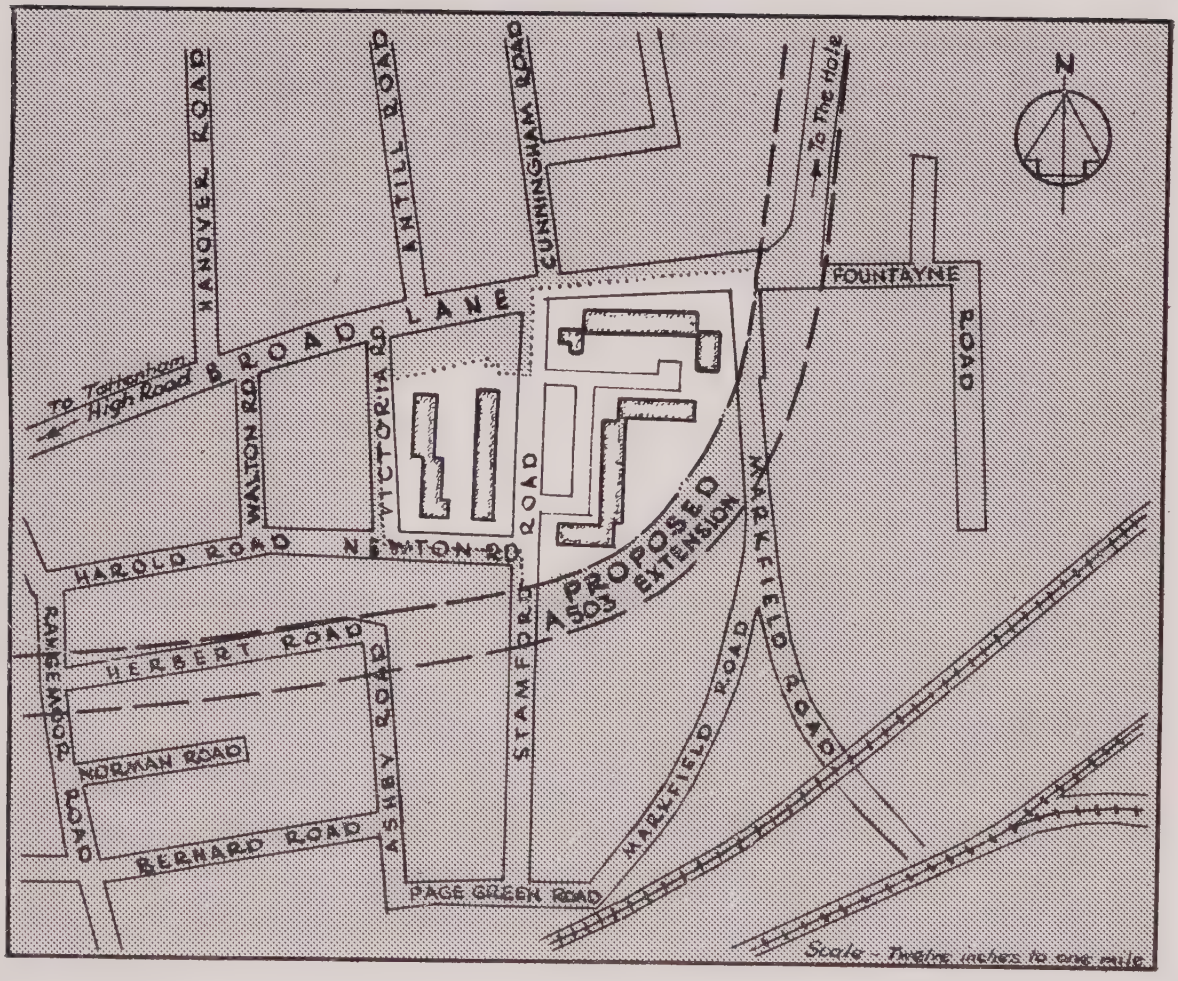
The general effect of the Order is to prohibit the emission of smoke (which for this purpose includes soot, ash, grit and gritty particles) from premises in an area of about $4\frac{1}{2}$ acres forming part of the Markfield Comprehensive Development Area, the whole of which is being acquired by the Corporation for redevelopment in accordance with proposals submitted to and approved by the then Minister of Town and Country Planning on the 30th July, 1947, under Section 1(i) of the Town and Country Planning Act, 1944 as an "area of extensive war damage"

The Tottenham (Markfield) Smokeless Area Order, 1954, relates to a part of the above-mentioned redevelopment area which before the war was largely closely developed with terrace-type houses, but as a result of extensive war damage practically the whole of the area was a cleared site before redevelopment operations began. The application of the Order to certain old premises still standing on the westerly and northern sides of the smokeless area is deferred until the 1st January, 1957, as it is contemplated that demolition and rebuilding will not have been accomplished on that part of the Area until then.

The cleared portion of the site is being redeveloped by the erection of 92 flats, and the appropriate smokeless fuel appliances to facilitate compliance with the Order are being installed by the Corporation as the redevelopment proceeds. The east and south-east limit of the zone, which follows no existing physical land mark, conforms with the boundary of a proposed major road which will intersect the Markfield Area.

The Corporation's intention is to consider, as early as practicable the submission of further Orders having the effect of extending the existing smokeless zone in order eventually to cover the whole of the Markfield Comprehensive Development Area, the southern portion of which it is intended to use for the relocation of industry.

Public reaction locally has been favourable, and some residents in the vicinity of the area have expressed the hope that the adjoining industrial



The Markfield Smokeless Zone Area, Tottenham

areas will soon be brought under similar control.

Following the usual wording of the model clause, Section 47 of the Tottenham Act excludes from compliance with any Smokeless Area Order smoke emitted from a railway locomotive, and the existence of a network of steam operated railways in the Borough will throw this up in sharper relief as control of emission of smoke from premises proceeds. At least one attempt has, however, been made by a local authority to bring railway locomotives within control, and the Corporation are hoping that before long this exemption can be removed.

The Tottenham Corporation will have the distinction of being the first local authority in the Greater London area to have an operative smokeless zone when the Order comes into force on the 7th January, 1955, the powers recently granted to the City of London Corporation in their Various Powers Act of 1954 not being capable of coming into operation until the 2nd October, 1955 at the earliest. It is not thought that any other authority in the Greater London area has so far secured similar powers.

Newcastle-upon-Tyne Health Committee decided at a meeting recently to serve statutory notice on the Northern Gas Board and the Central Electricity Authority to stop atmospheric pollution. Three months' notice is to be given to the Gas Board concerning the abatement of smoke at its by-product works at St. Anthony's Newcastle, after which the Health Committee will consider prosecution if there is a repetition of the nuisance. The case of the Electricity Authority, which is to get five months' notice, refers to grey dust emissions from Dunston Power Station. The Committee also passed a resolution inviting the Beaver Committee to Newcastle.

A NEW FRONTIER: AIR POLLUTION CONTROL

Abstracts from the Paper by Frederick S. Mallette, M.A.S.M.E. read to the Institution of Mechanical Engineers, 23rd April, 1954

The aspects of the problem covered by Mr. Mallette in this John Clayton Paper were as follows: historical background, legislation and local accomplishments, meteorology, the Donora smog, effects on health, development of instruments, problems of the iron and steel industry, control equipment, and socio-economic considerations.

Our limited space allows us to reprint only a fraction of this comprehensive and most informative paper, and the section that is likely to be of most general interest is the survey of what is being done in an outstanding way in certain cities and counties, including as it does consideration of special problems which are not without direct interest to this country.

IN 1912, the United States Bureau of Mines suggested "model" or "example" ordinances for small, medium-size, and large cities, based upon those rules in effect in Chicago and Des Moines. In 1924, a committee, composed of representatives from the American Society of Heating and Ventilating Engineers, the Stoker Manufacturers Association, the American Civic Association, and the American Society of Mechanical Engineers, prepared a comprehensive ordinance which contained engineering regulations on equipment dimensions. This model served as a guide for many towns.

The A.S.M.E., in 1949, published a bulletin prepared by a committee of the Fuels Division. Entitled "Example Sections for a Smoke Regulation Ordinance" (Model Smoke Law Committee 1949), it contains fifteen example sections with added helpful comments. In part or in whole, the sections have been used for making changes in old ordinances and as a basis for new local ordinances by over 100 cities. The ordinance recommended by the Coal Producers' Committee for Smoke Abatement is based upon the A.S.M.E. model.

To consider the legislation and accomplishments of every area in the United States and Canada that is active in air-pollution control would require a separate treatise. Therefore, only those places where outstanding efforts are being made are discussed. However, this does not imply that others are not making progress.

(1) St. Louis, Missouri. Probably the first large city that made an effective reduction in smoke pollution was St. Louis. Prior to 1940 the city was subject, particularly in the winter season, to smogs so dense that it was not infrequent to have street lights and automobile headlights burning until noon (Carter, unpublished).

St. Louis had established a Division of Smoke Regulation in the Department of Public Safety, in 1937, by an ordinance similar to those in common use in other American cities. It prohibited the emission of dense smoke, provided for fines upon conviction in the Police Court, and permitted the commissioner to seal offending furnaces. It required the obtaining of permits for all new fuel-burning equipment and inspection thereof in the field after installation. It also required that all bituminous

coal containing over 12 per cent. ash or 2 per cent. sulphur be washed to an ash content of not over 12 per cent. This ordinance did not succeed in improving conditions.

In December, 1939 the Mayor of St. Louis appointed a committee to investigate the smoke problem and to make recommendations. The committee concluded that local smoke pollution resulted from an almost universal use of high volatile bituminous coal for heating as well as for power. They recommended that the use of such coal be restricted to mechanical fuel-burning equipment, and that all fuel for hand-firing be of the " smokeless " type.

These recommendations were enacted into an ordinance in 1940. The ordinance prohibited the sale of high volatile coal in the city, except in sizes under 2 inches, and the washing provisions were continued. All these provisions, plus strict enforcement in spite of the war, brought about a tremendous change in the atmospheric conditions in St. Louis. For the year ending 1st April, 1953, the local United States Weather Bureau (located in downtown St. Louis) reported only $5\frac{1}{2}$ hours of moderate smoke on three days during the preceding twelve months. For the seven months from September, 1939 until March, 1940, the same office reported $716\frac{1}{2}$ hours of smoke. The situation is even better than these figures indicate, because the Weather Bureau changed its visibility standards during the interim.

The economic returns which may result from such an improvement may be estimated from a consideration of an earlier report (Anon. 1927), by the St. Louis Citizens' Smoke Abatement League, of an estimated cost of the smoke nuisance of over 14 million dollars for additional laundry, dry cleaning, and decorating bills, deterioration of sheet metal and exterior surfaces, loss of merchandise on shop shelves, the extra cost of artificial illumination, and so forth.

In its publications (Carter 1946), the Missouri Botanical Garden has pointed out the defoliating and other damaging effects on plants during smoke palls of a duration of less than 24 hours. In January, 1941, when the ordinance had been in effect only a short time, the Garden's bulletin mentioned beneficial results. " Certainly," it stated, " there has been such a marked improvement that one is inclined to become optimistic about the possibilities for successful gardening in the city."

Five years later the Garden's Director affirmed that the optimism was justified. The city's floriculturist had observed the same results in the parks and greenhouses. The St. Louis forester stated: " Now we feel safe in planting evergreens and even juniper in our downtown area. Previous to the adoption of the city smoke ordinance this was unthinkable."

Of thirty-three nose and throat specialists, twenty-nine were in almost unanimous agreement that " there has been a very definite reduction in infections of the upper respiratory passages and of the tracheo-bronchial tree." The eye specialists have noted a similar, if less marked, reduction in certain affections of the eye (Carter 1946).

While it is difficult, because of inflation, to determine savings from cleaner air in terms of dollars, it can be done in terms of labour. This was found to be true for maintenance of downtown office space. Surfaces are easier to paint than before because of the absence of soot and grime, and the wearing quality of painted surfaces, particularly on the exterior of buildings, has been increased by at least 25 per cent. (Carter 1946). In addition, the city has been beautified by the restoration and cleaning of many structures, which formerly had not been done because those structures would have become soiled again so quickly.

Householders and apartment-house owners report much less cleaning and maintenance is required than previously. Department stores and retail establishments claim lower losses from



Fig. 1. A former " black " day in Pittsburgh. Compare with Fig. 2, across, of Pittsburgh today, looking towards the Golden Triangle

soiled merchandise. The filters in air-conditioning systems do not require cleaning so often. The Union Electric Company of St. Louis claims that a saving of seventy-five thousand dollars a year in lighting bills has been made because of reduction in atmospheric smoke. All of these results were achieved by the elimination of three-quarters of the smoke from the atmosphere.

(2) Allegheny County, Pennsylvania. No definite discussion of activity in the field of air-pollution control would be complete without a consideration of the accomplishment made in Pittsburgh and Allegheny County. Only those who have a vivid recollection of the former " black " days can fully appreciate the difference in present-day Pittsburgh (Figs. 1 and 2). Although the city and county each have an air-pollution ordinance, and there is some question as to whether the one supersedes the other, the dramatic improvement in Pittsburgh's atmosphere appeared after the enactment of the City and County ordinance. Most probably, the great civic movement known as the Allegheny Conference on Community Development provided the stimulus and backing necessary to bring about the present change in the atmosphere of the areas.

Although it is entitled a " Smoke Control Ordinance " and is based, in part, upon the A.S.M.E. " Example Sections for a Smoke Regulation Ordinance," the County legislation has as its intent the eventual control of other air pollutants. It accomplishes this by including all " fuel-burning " equipment and by restricting not only smoke, but also fly-ash in the waste gases.

The general provisions apply to all classes of fuel-burning equipment with certain exceptions. Smoke of a shade or appearance darker than No. 2 of the Ringelmann chart is prohibited except in the event of breakdown or other failure not reasonably prevent-



Fig. 2

able. Excessive violations of this provision may result in sealing of the equipment when proved by the procedures of the A.S.M.E. "Power Test Code—Test Code for Dust Separating Apparatus, PTC-21-1941," or modifications thereof.

One of the important items of both city and County ordinances which had an early and marked effect upon the County's atmospheric condition is the definition of solid fuel for hand-fired equipment. The County ordinance states that the volatile content of several enumerated solid fuels must be 23 per cent. or less (for the city, 20 per cent. or less) on a dry basis, as determined by the test procedure of the American Society for Testing Materials. Those requirements almost at once freed the Pittsburgh air of its depressing smogs. However, at its effective date the County ordinance applied only to non-domestic hand-fired or surface-burning types of fuel-burning equipment; namely, central station power and heating plants, industrial power plants, and heating plants as defined.

Domestic hand-fired heating plants were not required to conform to the special solid-fuel requirements of the County ordinance until 1st June, 1953. When the heating season began in the autumn of that year, there was some organized resistance on the part of domestic users, especially in some of the suburban areas where there was easy access to lower-grade fuels. The County supervisors refused any further extension of the four-year period of grace, and there is no present evidence of extensive resistance to compliance.

To continue specifically with the County ordinance, a special section deals with locomotives and portable boilers. Although this section is restrictive and requires proof of progress in control of pollution, it has been rendered partially obsolete and the overall pollution problem has been markedly reduced by the almost complete replacement of steam locomotives, cranes, and other steam-powered equipment by Diesel-powered units. The report of the Allegheny County Bureau of Smoke Control for the year ended 31st May, 1953, which

was released in January, 1954, states that four Class 1 railways were completely converted to Diesel-powered equipment during the year and that the railways supplying commuter service have placed in operation a number of self-propelled cars, presumably Diesel-powered. The research programme which had as its purpose the elimination of 75 per cent. of the cinders emitted by steam locomotives was unsuccessful, but the rapid substitution of Diesel motive power for that of steam rendered this failure unimportant.

The provisions of the County ordinance covering the iron and steel industry included a number of exceptions and special sections, as follows: Smoke-control regulations do not apply to blast furnaces, by-product coke plants, open-hearth furnaces, sintering plants, Bessemer converters, or to cupolas except that a limit for fly-ash control (0.50 lb. per 1,000 lb. of gases, but not more than 85 per cent. of the total fly-ash) is provided for blast furnaces new or completely rebuilt subsequent to the enactment of the ordinance (and, after ten years, for all blast furnaces). Bleeding of cleaned gas only is permitted. By-product coke plants, open-hearth furnaces, and sintering plants are required to incorporate " economically practical " controls of smoke and fly-ash. Blast furnace " slips " are exempted from fly-ash limits, but research on this problem and also on control of open-hearth and Bessemer converter effluents must be undertaken or participated in by persons responsible for their operation. Emission limits are provided for heating furnaces, puddling furnaces, cupolas, and air furnaces.

The provisions of the city ordinance dealing with Bessemer converters are most stringent. These converters may not emit " such quantities of soot, cinders, noxious acids, fumes or gases in such place or manner as to cause injury, detriment or nuisance to any person or the public," and, in addition, their fly-ash emission is subject to an A.S.M.E. test for quantity and particle size. It is of interest that there are now no Bessemer converters in the City of Pittsburgh and only three in the county.

All this emphasis on the air-pollution problems of iron and steel production in Allegheny County and elsewhere has served to generate intensive study of the effluents of this industry and their control. This subject is more fully treated later.

Other provisions of the County ordinance govern commercial incinerators, towboats, and other river craft (Figs. 3 and 4), open fires, cement plants, and all other equipment emitting smoke. Of particular interest in this connection are the accomplishments which have been made in controlling the fires of gob piles (spoil banks, i.e., slag heaps) at coal mines or coal-preparation plants. It is reported that one of these piles in Allegheny County had burnt, until it was extinguished recently, for approximately forty-five years.

The County ordinance provided an interim of five years for mine operators to find effective solutions in preventing future fires. During that period progress was made towards developing better methods of piling the refuse. The Western Pennsylvania Coal Operators' Association has sponsored work on the overall problem at Mellon Institute, Pittsburgh, and at the Pennsylvania State University. The United States Bureau of Mines has undertaken an investigation of certain aspects of the problem, and experimental work is being done there which will complement rather than duplicate other activities.

No specific studies of the air-pollution problem caused by burning gob piles are available, but the many instances of odour complaint, house-paint blackening, and damage to vegetation, as well as the occasional fatality of coal pickers or of " derelicts " seeking warmth, brand them a nuisance and a hazard to the community. Concentrations of carbon mon-

oxide have been found to be as high as 1,500 parts per million on the surface of a burning pile, 340 parts per million at eight inches above the surface, and only at six feet above the surface did the concentration fall to zero. No figures are available for hydrogen sulphide or sulphur dioxide in the vicinity of these piles, but an observer passing to windward of a burning pile cannot fail to note the presence of these gases.

The dearth of field studies of the air pollution resulting from burning piles should be remedied. Better information would assist in the establishment of standards which could be used in considering legislation.

The Coal Waste Fellowship at Mellon Institute has been engaged in the following activities (Allegheny County (Pennsylvania) Bureau of Smoke Control):

(1) Development and application of a calorimeter for the precise measurement of the spontaneous heating of small samples of powdered coal and associated pyrites in the normally prevailing atmospheric temperature range.

(2) Field study of methods of refuse disposal and pile construction (compacting, sealing, and crushing operations, all in conjunction with layer disposal of refuse) and methods of refuse-fire control (spraying, grouting, and compacting operations). Improvements in these operations have been suggested.

(3) Educational efforts to arouse the interest of the operators in applying known control methods.

The State of Pennsylvania provided funds, which it required the industry to match, which supported work at Pennsylvania State University on engineering studies on refuse-pile fires, the construction of refuse piles, the cost of combustion control and observations on the most promising control methods.

The United States Bureau of Mines (Graf 1952) has exerted its efforts on studies of methods for the prevention of gob fires and the possible utilization of gob material. They found that methods of mining played an important part in the amount and composition of the refuse. For example, if less bony material and pyritic binder were to be mined and if more of the gob were to be stored underground in abandoned workings, the problem would be simpler.

Coal preparation affects the composition of the gob and the subsequent behaviour of the pile. Crushing the refuse is an important factor in preventing fires. While the finer particles are chemically and physically more active, the reduction of ventilation within the pile and the more rapid disintegration of rock material make up for the effect of increased surface. If washery refuse is separated into two ranges of sizes with differing pyritic content (and thus different affinities for oxygen), and if mine rocks are crushed for sealing material, spontaneous heating may be prevented.

Further experimental studies of mine-refuse fires have been summarized (Corey, unpublished) as follows:

> "For the past two years the Bureau of Mines has been conducting a series of investigations with the objectives of evaluating the variables that cause spontaneous heating in mine-refuse piles and of devising practical procedures for preventing spontaneous ignition in such piles. The laboratory studies have been carried out in specially-designed test boxes, in which the important variables can be controlled, and the field studies have been made on refuse piles at a large, local, underground mine with a modern coal-preparation plant. This plant handles about 1,000 tons per day of washery refuse.
>
> "Two identical tests boxes were designed and constructed for handling 2,000 lb. of refuse each, and were provided with electrical strip heaters in a manner to produce a localized hot spot within the charge. The power input to these heaters was increased stepwise to simulate

the gradual development of the hot spot. The use of two boxes made it possible to conduct check tests or two tests under different conditions, simultaneously.

" Five tests have been completed, three with $\frac{1}{4}$ inch and 0 inch refuse of different moisture contents, one with $3\frac{1}{2}$ inches and $\frac{1}{4}$ inch refuse, and one with $3\frac{1}{2}$ inches and 0 inch refuse*. The original refuse was $3\frac{1}{2}$ inches and 0 inch, and all came from the same source. Its pyrites content was about 5 per cent., the fines containing about 15 per cent. and the coarser material about 3 per cent. of pyrites.

" The $\frac{1}{4}$ inch and 0 inch was heated stepwise in the test box until the heating elements were 900° F. and no evidence of spontaneous heating was found. However, for the same rate of power input to the heaters the $3\frac{1}{2}$ inches and $\frac{1}{4}$ inch fraction began to burn spontaneously at 400° F., and the $3\frac{1}{2}$ inches and 0 inch at 200° F.

" It was concluded from these tests that size consist (content) may be the most important variable in spontaneous ignition of coal as it controls the amount of ventilation of a pile, other things being constant. Laboratory tests had shown previously that the relative air permeability of $3\frac{1}{2}$ inches and 0 inch, the $3\frac{1}{2}$ inches and $\frac{1}{4}$ inch, and the $\frac{1}{4}$ inch and 0 inch, sizes were 5, 25, and 1, respectively. The pyrites content and the specific surface of the gob appear to be a secondary importance. Further tests are scheduled to evaluate the magnitude of the specific effects of these variables.

" Since the fines were found to be comparatively inert, arrangements were made with the co-operating mining company to separate the fines from the refuse and use them, instead of loam, to seal the flanks of mine-refuse piles at the mine site. This procedure has been used successfully for about one year. Its only shortcoming is the tendency for heavy rains to erode the layer of fines on the flanks of the piles, which necessitates some maintenance at such times. The net savings over previous practice, however, are substantial. Moreover, fires in two piles were successfully extinguished by sealing them with fines."

As for utilization of gob material the Bureau dismissed several proposed uses because of limited application or economic impracticability. Among them are the following: recovery of tars and chemicals, production of activated carbon and of carbonaceous exchangers for water softening, recovery of rare elements, such as germanium or gallium, the use of crushed gob as a soil darkener and as a ground fill. " Red Dog " (burnt rock for road aggregate) is the only present commercial product of gob utilization, but its production causes air pollution.

Some of the more promising prospects of gob utilization are the heating, value of gob to be used for power generation, the recovery of pyrites and marcasite, and its chemical processing for the recovery of sulphur.

However, so far as air-pollution control is concerned, the best remedy appears to be to avoid the conditions which support combustion. A summary (Zimmerman 1952) of the replies to a questionnaire disclosed that of 487 piles, 158 were burning, 231 were not burning, and 98 were burnt out. While over 60 per cent. of the replies indicated that no method of control was being used, there were others which listed various procedures in use. Such procedures were layer piling with or without clay, sealing with clay or fly-ash, digging out and back-filling, crushing, or use of water.

Proper piling seems to hold the most promise in gob-fire prevention. It was found difficult to generalize as to what constitutes proper piling, but certain fundamental principles have been laid down (Anon. 1952). Using cut and fill, in hilly terrain every effort

* 0 inch as used in refuse dimensions indicates that fines were included.

should be made to have the edges of the pile sealed against an impervious barrier. The optimum thickness of layers probably depends on local factors, but, when laid down, the layers should be kept horizontal and approximately 4-6 feet deep. A rule which seems to give good results is to use a layer which, when compressed, yields a final thickness of 2 feet.

For modern coal-preparation plants with a large tonnage of refuse (2,500 tons per day or more), proper disposal presents a formidable problem which requires careful consideration and planning. At present, however, well-compacted and sealed refuse piles offer maximum protection against fire. Compaction of the edges of the pile can be easily attained by the use of an edge-roller.

(3) New York City. The City of New York has an area of approximately 300 square miles, with a large harbour and many miles of shore line. It is estimated that more than 1,000 ships enter and leave the port each month. The city contains about 141,000 multiple-family dwellings which possess about 9,000 flue-fed incinerators. Factories in the city range from 30,000 to 50,000 in number, depending on the definition used. On the streets there are approximately 128,000 lorries and 11,500 taxicabs, and there are about 1,250,000 automobiles registered within the city limits. 'Buses traverse the 5,700 miles of roadways. All of these sources add to the atmospheric pollution in the city (Greenburg 1953).

Studies of the New York pollution problem began about 1928 when Owens-type recorders were set up in a number of locations in the city. Several other studies followed, one of which, made during the period 1936-38, was most extensive.

A smoke control ordinance adopted in 1949 provided for the organization of a smoke control bureau in the Department of Housing and Buildings. In 1952, an ordinance was passed

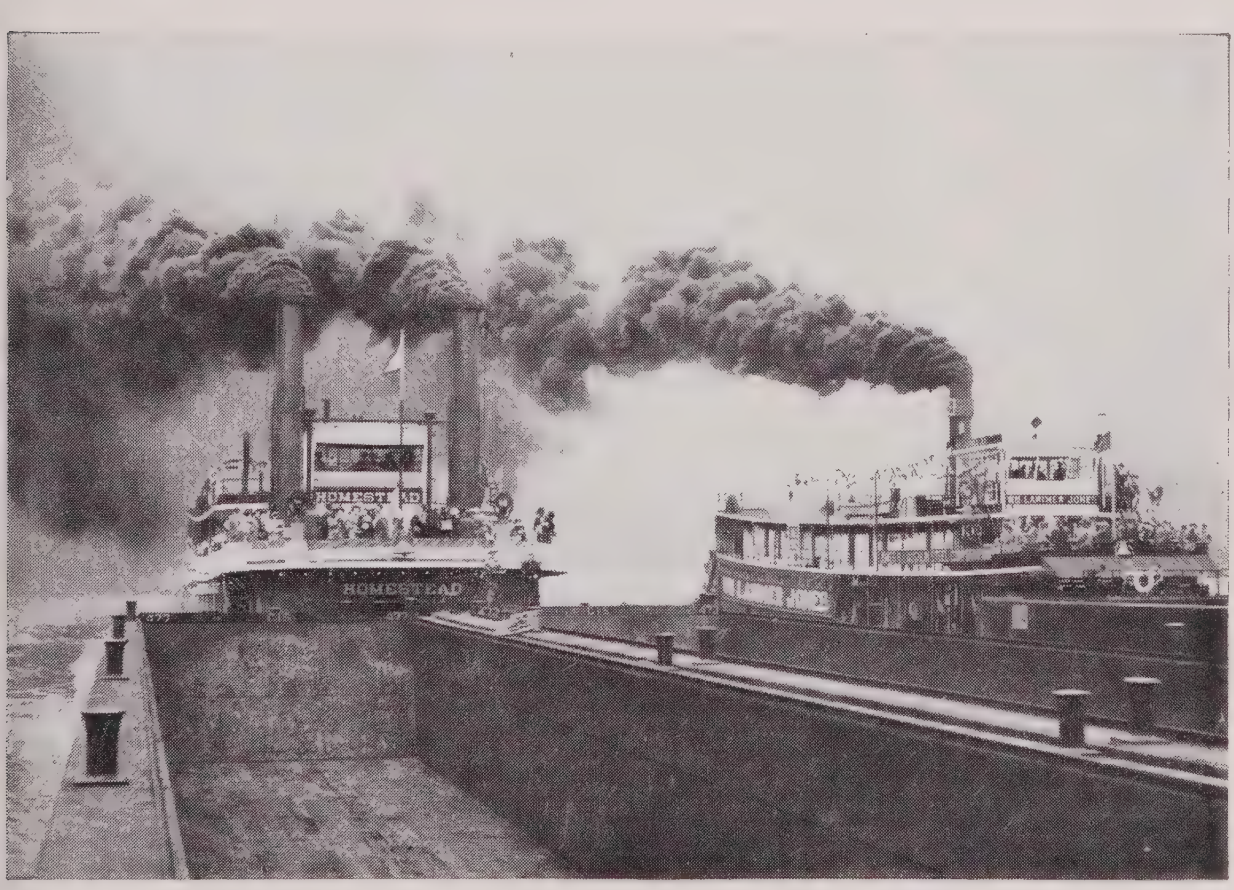


Fig. 3. Stern-wheel towboats in the Allegheny County area, showing smoke problem

providing for control of all air pollution and for a new Department of Air Pollution Control.

Among the sources of pollution are those mentioned above, plus the power stations, private and municipal, which altogether burn about the equivalent of 10 million tons of coal, of which approximately 97 per cent. is bituminous. These utilities also consume enormous amounts of fuel oil and natural gas. Some of the boiler equipment of the city's power plants is forty years old, with poor control over smoke and fly-ash.

Formerly, anthracite coal was used almost exclusively in domestic heating plants, but this has gradually been replaced by bituminous and by oil and gas. In 1936-37 the consumption of anthracite and coke was about 11.6 million tons. By 1951 the figure was only 3 million. The use of bituminous coal increased to 10 million tons in 1951 from 7.5 million in 1936-37.

Private incinerators, serving about 15 per cent of the city's population, consume 400,000 tons of refuse a year. Most of this equipment is badly designed and operated, and it produces enormous amounts of smoke fumes, and fly-ash. Rules have been adopted, to become effective on 1st January, 1955, which are aimed at bettering this problem.

Vehicular consumption of fuel amounts to about 1.1 thousand million gallons of petrol for passenger cars and approximately 20 million gallons of petrol and Diesel fuel for 'buses.

Created to handle the gigantic pollution problem from all these sources, the Department of Air Pollution Control consists of: a commissioner, deputy commissioner, and secretary; an inspection bureau of twenty-eight field inspectors and two marine inspectors; an engineering bureau of eleven engineers; a research bureau of four chemists; a records bureau; and the necessary clerical assistants.

The air-pollution problem in New York City is being attacked vigorously and intelligently. A severe smog episode during November 1953 spurred public interest and supplied necessary public support. The commissioner, who is both an engineer and a physician, has planned his attack along epidemiological lines, like any other public health problem. Complicating his task are the sources of pollution in bordering States, particularly New Jersey. To resolve this difficulty an interstate agency may result similar to the Interstate Sanitation Commission which handles stream pollution problems for New York, New Jersey, and Connecticut.

(4) California. Primarily to meet the needs of the Los Angeles basin in alleviating its air-pollution problem, the California legislature passed a law in 1947 which created a control district in every county (Kennedy 1952). This was necessary because Los Angeles County includes some forty-four incorporated cities. The district is given jurisdiction of the entire County. To activate any district, the board of supervisors must publish notice, hold hearings, and find that the air of the County is polluted and that local ordinances cannot be relied upon (only Los Angeles and Santa Clara Counties have so acted, and only the former has an existing enforcement body).

The Act provides for the organizational structure of the district with an executive officer and an independent hearing board of two lawyers and an engineer to hear appeals and grant variances.

The Act further provides for the prohibition of certain air pollutants specifically, but also is made all-inclusive by a clause which forbids the discharge of any contaminant which would constitute a Common Law nuisance.

It also provides that the air-pollution control board (the board of supervisors or other governing body of the district) may make rules and regulations which have the force and effect of law. However, the State itself has established standards and has made a violation of the rules a mis-

demeanour. At first, orchard heaters, which meet a simple standard, and agricultural processes were exempted, but an amendment in 1949 authorized the application of the permit system to orchard heaters. These devices, called " smudge pots," which give off a great deal of smoke and little heat, are used to warm the citrus groves to prevent freezing. Efforts are being made to design a heater which would give off more heat and less smoke, for the pollution created during a cold spell by the more than one million smudge pots in Los Angeles County alone creates a problem all on its own.

(*a*) *First Control District.* As soon as the Act became effective, the Los Angeles County Air Pollution District was activated. Rules and regulations were adopted, setting up a permit system for both the construction and operation of any equipment which might cause the emission of air contaminants. A " grandfather " clause automatically granted a permit to devices in operation when the rules became effective on 1st February 1948. Detailed plans and specifications must be filed before a permit will be granted for new construction or modernization.

The rules forbid the excessive discharge of a number of specific pollutants, for example, particulate matter over 0.4 grain per cu. ft. at a standard temperature of 60° F. and pressure of 14.7 lb. per sq. in. Emission of sulphur compounds, calculated as sulphur dioxide, in excess of 0.2 per cent by volume, is forbidden. Solid products of combustion in excess of 0.4 grain per cu. ft. of gas, calculated to 12 per cent of carbon dioxide, are forbidden. Later a rule was adopted forbidding the discharge of dust or fumes in accordance with a sliding scale based upon quantity processed per hour. Examples taken from the rules are given in Table 1.

Basing emission on the figures for quantity processed has the advantage of forcing large industries to stricter compliance, the theory being that they can utilize control equipment to better economic advantage and also that their effluents are apt to be more objectionable.

The rules and regulations can be amended by the same procedure of notice and hearing as when first established. This makes for a simpler procedure than going back to the legislature whenever a new pollutant or a better test is found. Similarly, the rules can be made more stringent or may be relaxed depending on the requirements of the problem at the time.

TABLE 1. EXAMPLES OF SLIDING SCALE OF MAXIMUM PERMITTED DISCHARGE

Quantity processed per hour, lb.	Maximum weight of discharge per hour, lb.
50	0.24
100	0.46
500	1.77
1,000	2.80
2,000	4.14
5,000	6.67
10,000	10.00
20,000	16.19
60,000 or more	40.00

New installations which might be the source of air pollution have been forestalled by the provision demanding detailed plans and specifications. This procedure has also safeguarded industry against the sale of worthless control equipment and has provided the expert advice of the district engineers. The section requiring stack analyses from companies has not only prevented the control district's staff from being overwhelmed with field work, but has made industry conscious of its contribution to the general problem. As from 1st September 1952, district engineers had approved permits for equipment valued at 88,647,500 dollars, of which 11,242,900 dollars were for control.

Permits may be revoked as well as granted. This provides strict control over the careful operation and maintenance of control equipment once it has been installed.

(*b*) *Amendment.* Recognizing the fact that air pollution knows no

boundaries, the California legislature, in its 1949 session, amended the Act to permit two or more contiguous Counties, where control districts have been activated, to consolidate into one district. The cost would be divided among the participating Counties in proportion to their population. As yet, no action has been taken to form such a merger, as Los Angeles County has the only activated district. There is, however, current public pressure in several Counties contiguous to Los Angeles, as well as in the San Francisco Bay area, to form control districts.

(5) Los Angeles County. With interest now becoming prevalent in the combating of all types of air pollution rather than of smoke or fly-ash alone, smoke-control ordinances are being supplemented by broader coverage. Typical of these latter rules are those in force in Los Angeles County, California.

A comprehensive paper on air-pollution control activity in the United States must include adequate consideration of the significant accomplishments which have been made in Los Angeles County, during the past seven years. The local problem, which appears to be unique in its characteristics and composition, began to develop during the tremendous industrial expansion (more than a thousand million dollars in new capital investments from 1941 to 1950) and population growth (4,116,901 in 1950) of the period of the second world war. The populace gradually became aware of several objectionable features which detracted from the famous Southern California climate, namely, an intermittent decrease in atmospheric visibility, with which were associated marked irritation of the eyes and upper respiratory tract and unpleasant odour. At the same time two other features became apparent, namely, an accelerated cracking of rubber, most noticeable in the sidewalls of tyres, and a peculiar damage to vegetation, especially certain garden crops. The relation of these two problems to air pollution was not discovered until later.

Public demand finally brought about the necessary enabling state legislation and, in 1947, the Los Angeles County Air Pollution District was formed. This body can study the problem regardless of city limits, and it has been given the legal tools to enforce the measures necessary for improving the situation.

This remarkable organization (Anon. 1950-51), with a staff of over 100 people and an annual budget of approximately half-a-million dollars, has its own building, equipped with laboratories, engineering quarters, offices, and a library, Its inspectors police an area of 4,083 square miles.

In addition to enforcement and educational activities aimed at early control of the most obvious sources of smog, a programme of research (Haagen-Smit 1952) has been carried on at the District Laboratory and also, through contracts, at the California Institute of Technology, the University of California, Chaney Laboratories, the National Bureau of Standards, and Beckman Instruments, Incorporated. Thus, experts in many fields—analytical methods, plant physiology, instrumentation, meteorology, and aerosols—focused their attention on the problem.

Another group delving into the problem was the Stanford Research Institute which had been engaged by the Western Oil and Gas Association, representing about 200 California oil companies. There ensued a most extensive programme covering a period of five years and costing 1.25 million dollars (Stewart 1953). This has resulted in the addition of a wealth of information on the air-pollution problem (Stanford Research Institute).

While it is apparent that meteorological factors must play an important part in the accumulation and retention of the smogs, a careful study (Stanford Research Institute) failed to disclose any significant change in average temperatures, humidity, wind speed, total sunshine, or rainfall over a fifty-year

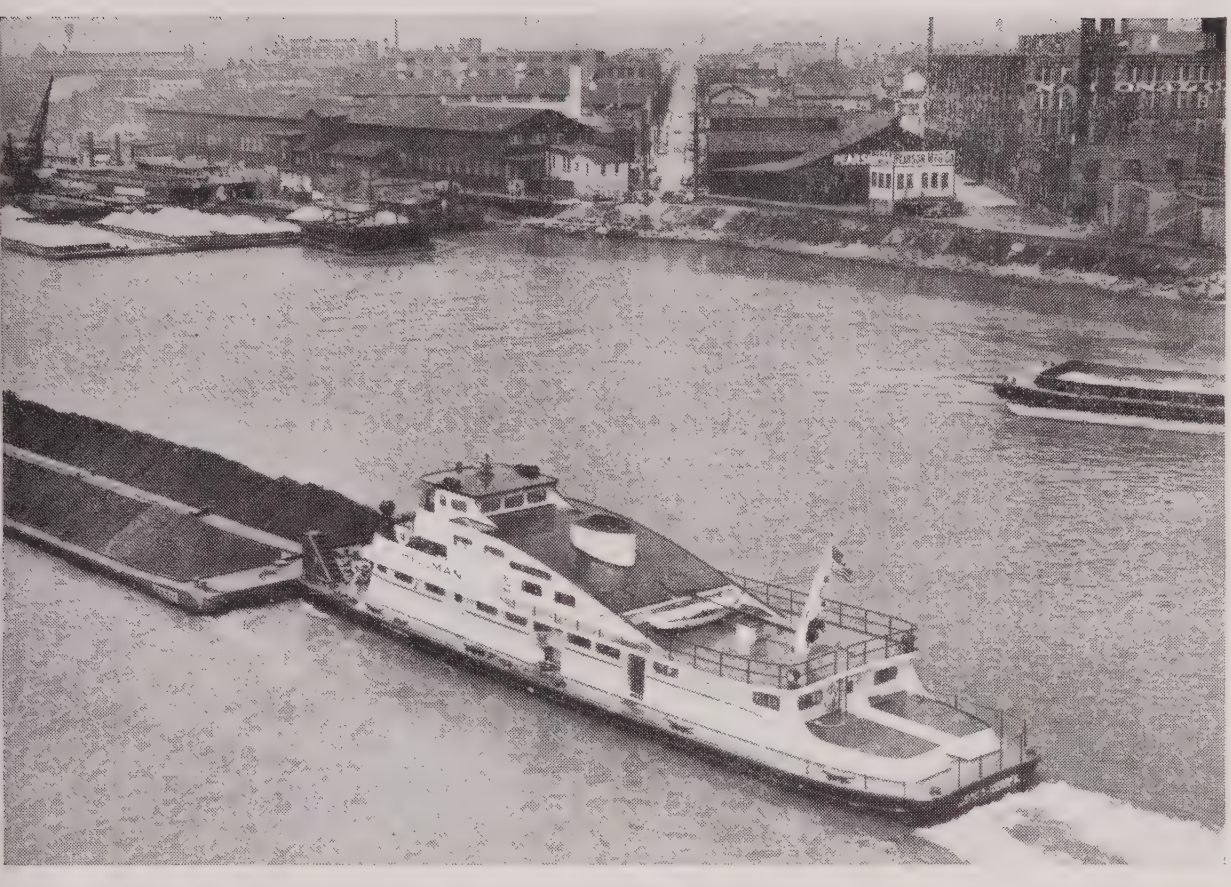


Fig. 4. *A modern Diesel towboat, Allegheny County*

period. Nevertheless, a temperature inversion exists above the city (and most of the County) during approximately 270 days each year (Magill and Littman 1953). The height of these inversions varies between the surface and 3,000 feet. When the inversion descends below this level, smog begins to be apparent, but only on fifty to seventy days a year does it become low enough to produce pronounced effects. The smog season is normally thought to be during the months of August, September, October, and November, but during the winter season of 1953-54 there were many severe days during December and even in January.

A glance at the topographical map revealed that the area was hemmed in on three sides by mountains, with an open side toward the ocean. The local winds are usually of low velocity (averaging 5 m.p.h. during August, September, and October) and are of a diurnal type, alternately blowing inland by day and out to sea by night, but seldom succeeding in cleansing the area of its accumulated pollutants.

Practically no coal is used in the County. Therefore, fly-ash and soot are not local problems. There are more than 2 million automobiles contributing their exhaust gases. They consume approximately a hundred thousand barrels, or over 4 million gallons, of petrol per day. The Control District believes that the development of local areas of smog follows the ebb and flow of automobile traffic (Larson, unpublished). Waste disposal contributes considerable smoke, as there are fifty-five burning dumps and about a million individual backyard incinerators.

The County contains industrial plants of almost every description, but the public has come to believe that the petroleum refineries are largely responsible for the smog. In part, this belief is based upon the discovery by Haagen-Smit (1950) that hydrocarbons in the air could be oxidized to produce the compounds which would damage plants

and cause eye irritation. The work was substantiated in experiments by control-test chambers.

Studies indicated that during a smog the most characteristic chemical property was a strong oxidizing action. After some fifty compounds had been tried in an effort to reproduce the typical damage on indicator plants, such as spinach, sugar beets, endive, alfalfa and oats, success was achieved with the reaction products of ozone and unsaturated hydrocarbons. Maximum damage was found to occur with olefines of a chain length of five to six carbon atoms with the double bond in the end position. Petroleum fractions, boiling between 39 and 69 deg. C., produced severe damage also.

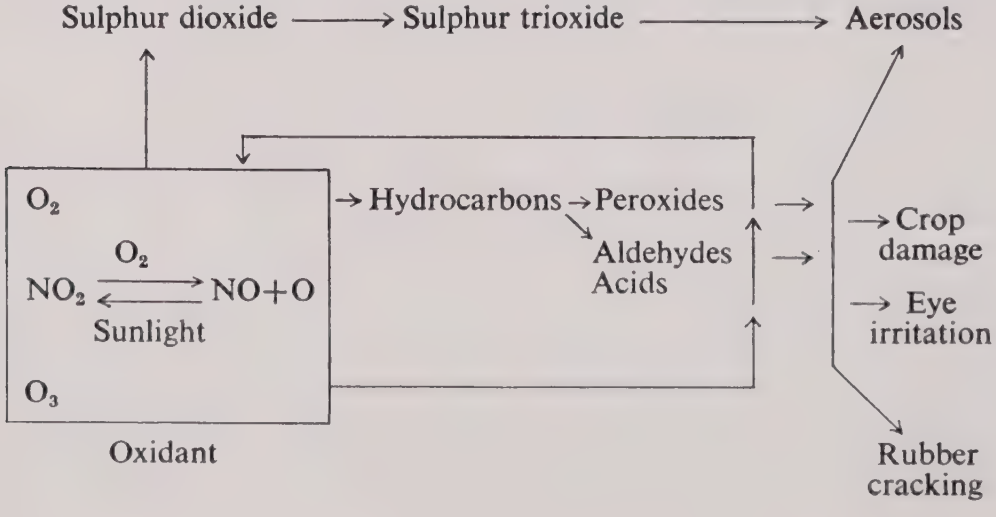
The relation between severity of smog and cracking of rubber was also demonstrated (Haagen-Smit 1950). Cracking of standardized rubber may be used as a sensitive index of ozone concentration. On smog-free days the normal cracking time is from 40 to 60 minutes, indicating an ozone concentration of 0.02-0.03 parts per million. During severe smogs as much as 0.22 parts per million of ozone have been measured, corresponding to a cracking time of only 6 minutes. The effect, however, was not found at night.

Similar experiments using oxides of nitrogen, especially in the presence of sunlight, gave typical smog damage on plants as well as the characteristic smog odour and eye irritation. Haagen-Smit represented the various atmospheric reactions in smog formation in the following diagram:—

The atmospheric oxidant is represented by a complex of factors consisting of atomic oxygen formed by the photochemical oxidation of organic material. The oxidant, by reacting with hydrocarbons and their oxidation products, produces peroxides and further degradation products. The peroxides or their radicals in turn play a part in the formation of ozone. Sulphur dioxide is believed to be oxidized to sulphur trioxide, contributing to the decrease in visibility. This change is catalyzed by the presence of the nitrogen oxides which are released at the same time in combustion processes.

The investigating group at Stanford Research Institute does not accept Haagen-Smit's theory (Magill and Littman 1953). Their experiments showed that saturated hydrocarbons did not increase the amount of ozone formed, whereas unsaturated hydrocarbons rapidly consumed the ozone. They consider that " the most likely explanation for the occurrence of ozone near ground level is that it is formed as a result of reactions in the atmosphere brought about by the presence of sunlight and some as yet unidentified atmospheric impurities."

Although definite strides have been made during the five years of enforcement in Los Angeles County, the public reaction, as judged by the amount of local-newspaper space devoted to the subject, indicates that the situation is worse. During the latter part of 1953 two deaths were reported to have been caused by smog,



and the County medical society began a drive for an extensive research programme. Local business men joined in the formation of the Southern California Air Pollution Foundation.

In fairness to the efforts of the Control District, it should be pointed out that an estimated 600 tons per day of pollutants have been eliminated. There is no longer random burning at the fifty-five commercial and municipal dumps. Rigid control of the thirty-four iron foundries has been achieved. Steel open-hearth and electric furnaces have been controlled at considerable cost and effort. Conversion to Diesel-powered units of the major railways is now complete. There is less sulphur in the air than in the early 1920's. About 4 million dollars will be spent within the next two years for control measures, including floating roofs or vapour-recovery systems on petroleum storage tanks. Nevertheless, the autumn of 1953 was considered to have had some of the most severe smogs within memory.

Population growth is at the rate of 400 per day. Industry is growing apace. New refinery capacity planned for 1954 will boost output by 220,000 barrels per day. In December 1953 a political crisis over air pollution developed which has not yet been resolved. Out of it will probably come an effort at stricter enforcement which may or may not result in more progress than is at present being made.

(6) Canada. Canada is, in general, a sparsely populated country and except for certain industrialized areas, most of which are situated near the American border, it has not been troubled with serious air-pollution problems.

As early as 1913 the smoke problem was considered, as evidenced by the Fourth Annual Report of the Commission of Conservation (issued in Ottowa, 1913). Later came the investigation into the difficulties due to sulphur dioxide of the Trail (British Columbia) area, and into the Detroit-Windsor border problem by the International Joint Commission. Professor Allcut (1953) has collected information from forty-four of the larger population centres, of which seventeen have no by-law, eight passed by-laws before 1946, and thirteen did so after that date. Most of the by-laws had some clauses based upon the Ringelmann chart. A few limited the emission of dust and fly-ash to a maximum stack-loading of 0.85 lb. per 1,000 lb. of gases (adjusted to 12 per cent carbon dioxide). Other provisions of the by-laws called for smoke indicators, installation and operating permits, annual inspections, and set fees, and prohibited generally the emission of odours and noxious gases.

In 1949, the Committee on Atmospheric Pollution was appointed to study the problem and to draw up an example code to cover all air pollution. Recommendations were made for the organization and powers of an air-pollution-control agency which could be adapted to local requirements.

Professor Allcut found no comprehensive studies available of air pollution in Canada, but presented a summary of the activities of the smoke-abatement authorities of Toronto, Ontario. At present a survey of Toronto is being made, and will, therefore, be available for comparison with a similar study made in 1932-33.

The Trail problem is discussed elsewhere in this paper, but Professor Allcut calls attention to a similar situation in the Sudbury (Ontario) area where approximately 40-50 thousand tons of sulphuric acid are recovered annually from stack gases in nickel-copper smelting. However, it is believed (Katz, 1952a) that the annual emission of sulphur from the three smelters in the area may be as high as a million tons and that other plants, now operating or under construction have an additional capacity of 246,000 tons a year.

Poisoning of cattle and wild life, and human illness in the Yellowknife (Northwest Territory) area led to an investigation which found that the local roasters were emitting excessive amounts of arsenic trioxide. The study is continuing and some control equipment has been installed. Unfortun-

ately, the latter activity included the use of wet scrubbers, which resulted in a water-pollution problem. Present efforts are being aimed at all elements of the environment—air, soil, water, and vegetation—in an attempt to ascertain allowable limits of contamination.

Professor Allcut points out that much of the smoke problem created by the transportation industry is being resolved by conversion to Diesel-powered units or substitution of liquid for solid fuels. While he regards this change as desirable as regards air pollution, he calls attention to the danger, in time of crisis, of almost total reliance on liquid fuels.

Professor Allcut also calls attention to an occurrence involving the new atomic-energy industry, where a small leakage of radio-active material occurred at Chalk River (Ontario) in December, 1952. Ground-level dispersion there is prevented by using high stacks, of from 450 to 550 feet in height.

For details and further information on Canadian activity in the field of air pollution, references may be made to the paper by Allcut (1953), which has an extensive bibliography.

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Port Talbot Health Committee has recommended that the council support a proposal of the National Farmers' Union that the Borough Council, together with the Penybont Rural Council and the N.F.U., should approach the management of the Kenfig calcium carbide works in an attempt to secure a reduction of pollution which, it is claimed, is affecting crops and livestock in the area.

THE F.B.I. AND SMOKE LEGISLATION

The May, 1954, issue of *F.B.I. Review*, contained an article entitled " F.B.I. Action on Private Bills Protects Industry ", by the Secretary of the Technical Legislation Committee of the Federation of British Industries. One section of the article discusses legislation for smoke control, from which we quote :

" Four Corporations—Walsall, Coventry, Newport and Birmingham—sought to extend the provision of the model smoke clause adopted by local authorities. Both Birmingham and Coventry included powers to make it compulsory to obtain prior approval of the plans of every furnace to be installed, while Newport is seeking to extend these undesirable provisions to existing equipment.

" Perhaps the most significant has been the Walsall Corporation Bill, which sought to extend the clause dealing with smoke from industrial furnaces to cover dust as well. In the Federation's view the emission of dust is adequately covered nationally by the Alkali Works Regulation Act, 1906, and the Alkali Inspectorate of the Ministry of Housing and Local Government is better equipped to carry out its provisions than any local authority could ever be.

" Last year the F.B.I. opposed an identical extension in the Cheshire County Council Bill on the same grounds, but failed to convince the Ministry of Housing and Local Government, which reported in favour of the clause. It is particularly gratifying that the Ministry has had second thoughts and now accepts the F.B.I's contention, with the result that the amendment in the Walsall Bill has been deleted and the F.B.I.'s petition has been withdrawn.

" In Coventry, after discussions with the local authority and the strong local action which was taken, the original clause was withdrawn and the new clause substituted provides for the optional submission of plans. This is acceptable to industry. Negotiations with Newport Corporation were carried out on similar lines and resulted in the adoption of the model clause.

" In Birmingham the local authority has offered the Federation an amendment which will exclude certain types of plant from the provisions of the clause. This amendment is not considered satisfactory, and unless concessions are made a petition will be lodged.

" The Federation regards it as particularly unfortunate that a Corporation should seek legislation in its own area while the whole question of air pollution is the subject of an inquiry by a Committee set up by the Ministry of Housing and Local Government, since it is quite possible that national legislation will emerge from the report of this Committee. In addition it is held by the Federation that most local authorities could not afford to employ persons sufficiently qualified or experienced to deal with the complex designs submitted. The result might well be that progress would be retarded by the rejection of developments not known to them, at a time when in most branches of fuel practice there is urgent need for continued progress, which can only be achieved by experimental development."

A New Self-Sealing Coke Oven Door

Among the causes of smoke emission from coke ovens is its emission during the discharge of incandescent coke, especially if the ends are not fully carbonized. The prevention of this is one of the advantages claimed for the new " Goldschmidt " gas exhausting door plug, which can be fitted whether self-sealing or luted doors are used. Among the technical advantages is the more rapid carbonization of the oven ends, resulting in a quicker coke pushing schedule.

The invention, which is patented by Friederick Goldschmidt of Essen, Germany, has already been fitted to ovens in nearly a score of British plants. In some cases smoke prevention has been the primary reason for fitting the new door. Technical information and other particulars may be obtained from Mr. Gwynne Cellan-Jones, F.Inst.F., at 11, Finkle Street, Stockton-on-Tees.

THE N.C.B. ON SMOKE AND SMOKELESS FUEL

The Report for 1953 of the National Coal Board devotes three pages to air pollution and smokeless fuels. More than 200 million tons of coal a year are used in this country, and of this only about 8 million tons are naturally smokeless. The production of anthracite and the dry steam coals is limited by the small deposits available and the difficult geological conditions in that part of South Wales where they are mainly found. Two new collieries are being sunk, but although they may produce about 1.7 million tons of coal a year some of this will only replace production from other collieries which are nearing exhaustion.

The burning of raw coal smokelessly in industry is discussed, but for the domestic market " the only complete solution is to provide an intrinsically smokeless fuel." Coke production could be appreciably increased by using the poorer carbonization coals, but " any further increase in supplies of smokeless fuels would have to be made from non-caking high volatile coals, of which there are considerable reserves ".

Processes for making new smokeless fuels are referred to, and it is said that " certain processes that would produce smokeless fuels have been known for some years, but have been regarded as too costly to be worth developing. But if public determination to reduce air pollution grows, consumers may be willing to pay more for coal to be made smokeless, and processes previously regarded as too costly will then be worth adopting, unless cheaper processes are discovered in the meantime."

Mention is made of the development of Phurnacite production, which has been doubled since vesting date. Now, 300,000 tons a year, it is planned to extend the plant to a total capacity of 650,000 tons a year. At Stoke Orchard, research is being directed almost entirely towards the development of new processes for extending supplies of smokeless fuel.

Finally, this part of the Report says :

" The current investment programmes of the gas and electricity industries should help to give both Industry and householders, over the years ahead, more fuel and power with less smoke. Finally, and perhaps more capable of bringing improvement quickly, there is the investment which industrial consumers of coal are making with the installation of more efficient appliances, which, if properly operated, will burn coal smokelessly. In the past, this has not gone forward fast enough. The National Coal Board seek to encourage the necessary changes, but they cannot organize or control them."

A short but comprehensive article on the smoke problem and the means for its abatement, under the title " Towards Clean Air ", was contributed by Dr. W. R. Martine, Chairman of the Society's Executive Council to the April, 1954 issue of *Health Education Journal*. The Society has obtained reprints of the article, copies of which may be obtained on request. It will be found to be a helpful guide to those speaking on the subject.

Manchester Housing Committee has decided that no action should be taken for the present on the request of the Health Committee that it should be a condition of tenancy of all future lettings that only smokeless solid fuels should be utilized in houses and flats equipped with the necessary appliances in the Woodhouse Park area of Wythenshawe. The Housing Committee has approved the establishment for an experimental period of a voluntary smokeless zone in the Woodhouse Park area.

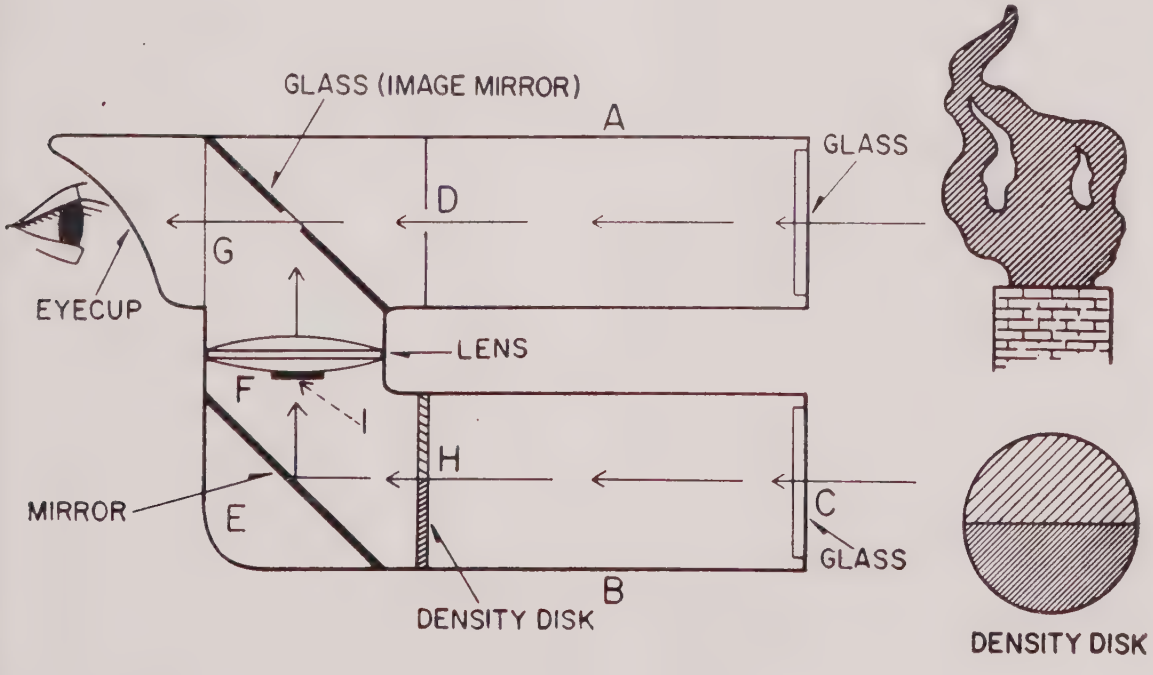
THE M.S.A. SMOKESCOPE

Many attempts have been made to devise an instrument for estimating the density of smoke, such as the Umbrascope, which is used in some places in the U.S.A., and one with revolving vanes, invented by the late Dr. J. S. Owens. No instrument seems to have been entirely satisfactory, and charts, such as the Ringelmann, have their own deficiencies. We reproduce a diagram which explains the principle on which a new instrument, the "Smokescope" has been devised and constructed by the Mine Safety Appliances Company of Pittsburgh, Pa.

The stack is viewed through the instrument and the smoke is seen through the apertures C, D and the centre section of image mirror, G. These apertures limit the field of vision to the area of the stack and prevent entrance of stray light. Light from the area adjacent to the stack is transmitted through the reference film disc H, in barrel B, to the front surface mirror E. By means of this mirror and lens F, an image of the reference film is placed upon the image mirror where it may be compared with the smoke as seen through the apertures. By placing the reference film at the focal point of the lens the light rays reaching the eye from the film are made parallel, thus projecting the virtual image of the reference film to infinity. The area of film is small and acts as a point source. Comparison of the smoke density with the reference can then be easily made without changing the focus of the eye. The principle used is that of the Nyder gunsight.

The advantages include the projection into space of the image of the reference standards, so that there is no need for re-focusing the eye, and there is the same background lighting for the smoke and the reference standard.

The first test instruments made have been equipped with references designed to give correlation with Ringelmann numbers 1, 2 and 3, and it has been found that it is not always possible to reconcile readings at shade 4 because of the influence of reflected light from such dense smoke. As, however, Number 4 smoke is a violation of any existing ordinance it was decided to delete this from the set of standards.



Domestic Heat Pump Soon

Hot Water—Cold Larder

A duel-purpose heat pump—to provide hot water and a refrigerated larder—will soon be on the market, said Dame Caroline Haslett, D.B.E., Director of the Electrical Association for Women, in a paper on electricity in the modern home at the British Electrical Power Convention at Eastbourne in June last.

Dame Caroline said that the Electrical Research Association was concentrating on the economic uses of the heat pump as a domestic installation. With a properly designed unit the running costs for space heating should be one-third of those normally required for electric heating and about half the cost of an electric water heating system using an immersion heater.

Some of the laboratory research had the benefit of trials that were going on in different parts of the country under actual working conditions. A special unit to provide a hot water supply and a refrigerated larder in an average household was tested in the houses of staff at the South Western Electricity Board, and at Electricity House, Bristol. It consisted of an evaporator of domestic type in the larder and a refrigerator compressor unit and condenser coil. The compressor and condenser were hermetically sealed and placed in a 30-gallon tank immediately above the larder and below the cold water supply tank in the roof space. Connections were made both to the hot and the cold water supply.

Satisfaction with hot water supply and larder cooling was expressed, and the conclusion was drawn that it would be to everyone's interests for progress to be made with the manufacture and sale of such dual-purpose units, for which there would appear to be a greater demand than for refrigerators alone. Householders would obtain two appliances in one, and the Area Boards would secure the highest load factor so far used by domestic consumers.

" Some manufacturers have already experimented with prototypes," said Dame Caroline, " and it is expected that this dual-purpose unit will soon be on the market. It will be in the form of a complete ' packaged ' unit to be installed in the larder, with pipe connections to the hot water storage tank."

The Titrilog

An instrument which can detect sulphur in concentrations as low as 0.1 p.p.m. was described in a paper presented to the American Chemical Society recently by H. Landsberg and E. E. Escher, of Consolidated Engineering Corporation. The Titrilog, as it is called, is a chemical-electronic instrument which, it is claimed, can record within 20 to 30 seconds any changes in sulphur concentrations.

The operation of the instrument is based on a titration. In the case of sulphur the titration is done with bromine. This is electrolytically generated in a solution which absorbs sulphur compounds. A feed-back amplifying system controls the bromine generating current so that the rate of bromine generation is at all times equivalent to the rate of absorption of the sulphur compounds. A meter records the generating current, which is always proportional to the sulphur concentration in the gas being tested.

A helicopter-borne Titrilog was used recently to determine sulphur concentrations in the vicinity of industrial chimneys.

Scientists studying Los Angeles smog agree that some of it is caused by substances that are not irritants when released to the air—but that later combine with other airborne chemicals to become irritants. Because of this, according to W. L. Stewart, of Union Oil of California, the day may soon come when it will be considered desirable to release additional chemicals into the air to inhibit reactions between contaminants.

NEWS.

The Gas Council, by agreement with the North Thames Gas Board, is assuming responsibility for the Watson House Centre, which will be administered by the Board on behalf of the Council. The Centre deals with the design and performance of gas and coke burning appliances and carries out the testing and approval of appliances. Mr. L. W. Andrew, B.A., B.SC., A.R.I.C., who has been Senior Technical Officer at the Centre has been appointed its Director.

The Ministry of Agriculture is to sponsor an investigation, probably in conjunction with the National Farmers' Union, of complaints of damage to horticultural crops by aerial pollution of holdings near the Thames estuary. The crops include produce from glasshouses in the Swanley district of Kent, where growers have contended that cement dust deposited on the lights of the glasshouses has had an adverse effect. Other crops, from the Purfleet district of Essex, although showing no sign of physical deterioration, have been found to be unsaleable because of the gritty dust embedded in them.

The Council of the British Oil Burner Manufacturers' Association has submitted a memorandum on industrial liquid fuel burning installations to the air pollution industrial sub-committee of the Ministry of Fuel and Power. Dealing with installations of not less than 500,000 B. Th. U. per hour the memorandum covers the main causes of air pollution by smoke and unburnt products of combustion and deals with them under sections entitled design, installation, operation and maintenance, training of operatives and instrumentation.

The F.B.I. is petitioning against the provision in the Birmingham Corporation Bill which seeks to extend the model clause relating to smoke from industrial furnaces. The proposed clause would make it compulsory to submit for the local authority's approval plans of all new furnaces to be installed.



Washing the Face of London

A recent photograph of a part-cleaned building in Grosvenor Place, S.W.1., near the Society's offices

Addressing the international conference on gerontology in London, Dr. J. Pemberton, senior lecturer in social medicine at Sheffield University, said that bronchitis, the commonest cause for which people consult their doctor in Sheffield, affected in varying degrees 44 per cent of the men and 38 per cent of the women in a recent survey of elderly people in Sheffield. The condition was found to be considerably commoner in the industrial eastern and north-eastern districts, where, among other things, air pollution is greatest, than in the residential western areas.

Deaths from lung cancer have almost trebled in Liverpool in the last eight years it is disclosed by Professor Andrew Semple, M.O.H. for the city. Figures have risen from 160 in 1945 to 432 in 1953. Last year there was an increase of 86 over the 1952 figure of 346. Describing the increase as "startling" Professor Semple says research for possible causation of lung cancer is going on nationally, and the Health Department is co-operating in one scheme to investigate the possible effect of atmospheric pollution on the incidence of cancer.

SMOKE PREVENTION ABSTRACTS

211. Physical Properties of Fog. E. G. Richardson. (Research, April, 1954, p.152.) In order to combat the effects of fog, studies are being undertaken of fog formation and potential methods of dispersal. The author describes some of the essential measurments in these studies and discusses the effect of fog on the transmission of light and sound.

212. Solar Energy for Water- and Space-Heating. Dr. H. Heywood. (J.Inst. Fuel 27, 334-352. July, 1954.) Rising fuel costs and shortages have attracted attention to the utilization of possible alternative sources of energy, which include direct solar radiation. The paper describes the solution of many of the technical problems involved in the application of solar radiation to domestic water-heating and space-heating of buildings. The characteristics of solar radiation, its transmission through the atmosphere, and the calculation of incident radiation on absorbing surfaces at various inclinations are discussed. The fundamental principles of operation of the flat-plate absorber are described. This is essentially a water cooled metal surface, glass covered on the front and thermally lagged at the back, and is generally fixed in position on the roof of a house or building. It has a collection efficiency exceeding 50 per cent at a temperature of about 140° F.

Researches on small-scale absorbers conducted at the Imperial College of Science and Technology, University of London, and on an experimental water heater at the author's residence are discussed, with test results for a 2-year period of operation. A brief description is given of three designs of solar-heated houses built in the U.S.A. and the prospects of utilizing solar energy in climates where higher and more uniform intensities of radiation occur are discussed.

213. Smog. R. S. Scorer (Science Progress, **42**, 396-405, July, 1954). The problem of smog is reviewed and it is concluded that the examination of average air pollution is of little value to the study of the effects of smog, which should be treated like other epidemics. The combustion products concerned in smog, solid particles, sulphur dioxide, carbon monoxide and carbon dioxide, are considered. Among factors discussed are the cooling effect of suspended solid particles, which scatter sunlight and make town fog clear more slowly than country fog ; the probability that almost all the conversion of SO_2 into sulphuric acid takes place on the surface of solid particles and the carrying of these particles into the lungs ; the importance of SO_2 and CO emission at ground level in populous streets by diesel vehicles ; and the increase in CO_2 concentration during smog. It is estimated that in smog the proportion of CO_2 in the air could increase to 4 per cent or more locally, and in such proportions is a stimulant to the heart and respiratory system to which young babies and bronchial sufferers are unable to adjust themselves. A further sector of the paper examines the question of smoke plumes and the effects of washing flue gases from power stations, and it is concluded that plume washing may be useful in times of wet smog but its value is to be questioned at other times. Power station chimneys should be as high as possible, the effluents as hot as possible, and new stations should be built as far as possible away from centres of population. On domestic smoke the author says : " If smokeless fuel were used the absence of smoke would be an enormous direct benefit, and, the radiative effects of solid particles being absent, the natural diluting processes would be much more effective, and the concentration of SO_2 would be enormously reduced. Such SO_2 as was present would be less harmful than when converted into SO_3 on the particles."

214. Smog. Meteorological Aspect by H. W. L. Absalsom ; Air Pollution Aspect by E. T. Wilkins ; Physiological Effects by N. C. Oswald. (J.R.Met.Soc., **80**, 261-278, April, 1954). The three papers reviewed the aspects indicated and were followed by a general discussion. In the first paper a series of 12 charts were given showing the distribution of fog in the London area between 5th and 9th December, 1952. In discussion on the sulphur dioxide concentration during the smog, Wilkins stated that measurements showed a total rate of accumulation of about 70 tons per day over Greater London at the depth of the fog, 300 feet. The total SO_2 released to the

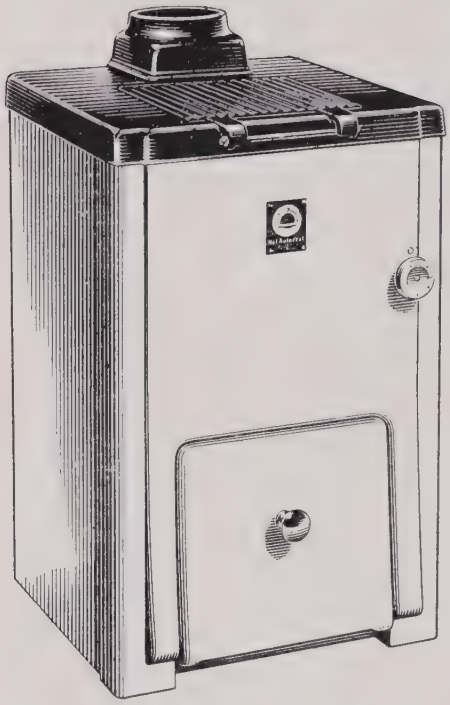


An illustration from the article by R. S. Scorer, abstracted on the previous page, showing the plume from a cement works in a Derbyshire valley. The smoke has accumulated to fill the valley under an inversion of temperature during a winter night. Although it penetrates through the inversion on account of its upward momentum, the plume sinks back again because it has not enough buoyancy.

atmosphere in the area was in the order of 2,000 tons a day, so that the natural removal of SO_2 from the smog accounted for the equivalent of 1,930 tons out of each 2,000 tons emitted. On this basis, therefore, the death roll and other pollution effects of the fog could be attributed to a decrease of only 4 per cent in the operating efficiency of the natural cleansing process. The contribution by Oswald discussed briefly the action of fog and other irritants in fog on the respiratory system and the effects on bronchitics and asthmatics.

215. The Small Underfeed Stoker. W. D. Smith. (B.C.U.R.A. Monthly Bull., **18**, 189-202, May, 1954.) The small underfeed stoker is a reliable appliance widely used for domestic heating and under normal conditions is capable of smokeless operation. Apart from the stokers fitted with an automatic ash-removal mechanism, the majority are not fully automatic since the fire must be cleaned manually. The most serious disadvantages of the underfeed stoker are the tendency of the feed mechanism to jam, and the crushing and segregation of the coal in the feed tube, although much has been done to overcome these troubles. The production of coke trees from normally non-coking coals is a well-known phenomenon on the stoker, and the several attempts which have been made at controlling their formation have achieved some success. A wide variety of coals can be used on the underfeed stoker, but the use of strongly caking coals and anthracite is not recommended, although the latter may be used when blended with bituminous coal. A test procedure, involving the use of a standard stoker and simple boiler, has been established for the selection of coals for use on the stoker. No attempt has been made to use a combustion pot type of test for this purpose, no doubt because of the type of air distribution and the mixture of underfeed, overfeed and cross feeds which exist on the stoker and which cannot be reproduced in the combustion pot.

Penrith magistrates were told in a recent case that the driver of a police car was unable to see past a vehicle which he was trying to overtake because it was emitting so much smoke. The driver was fined £1 for failing to prevent the emission of smoke, and his employers were fined £3 for causing the lorry to be on the road.



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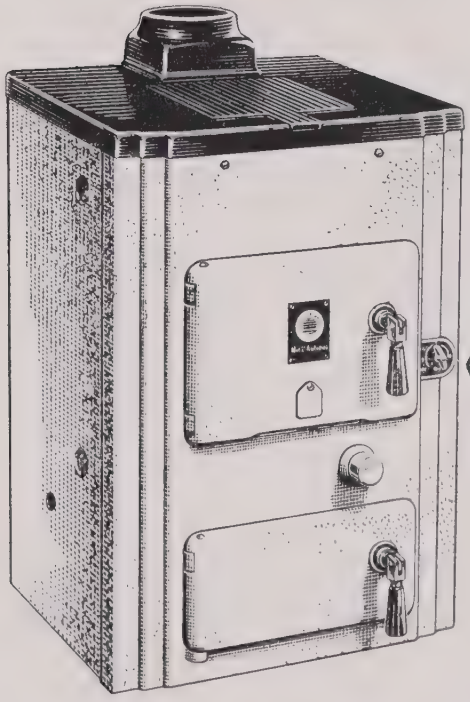
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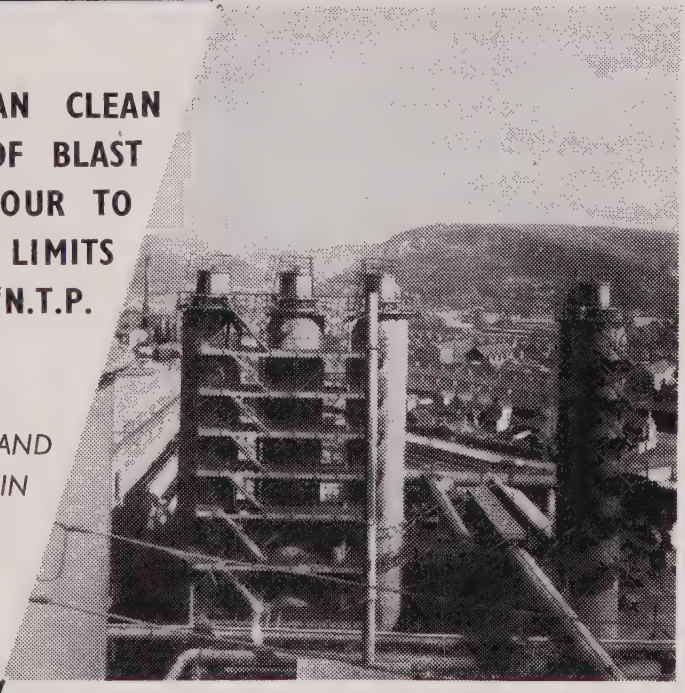
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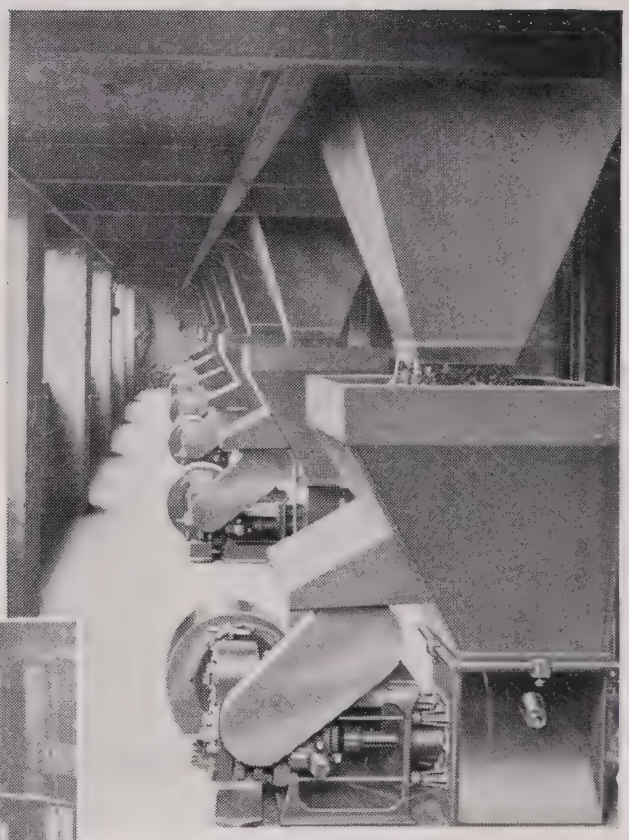
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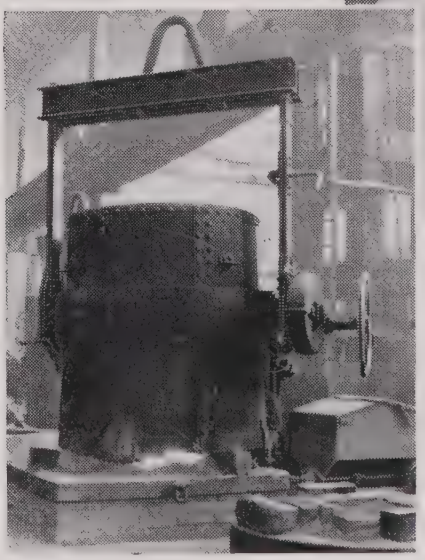
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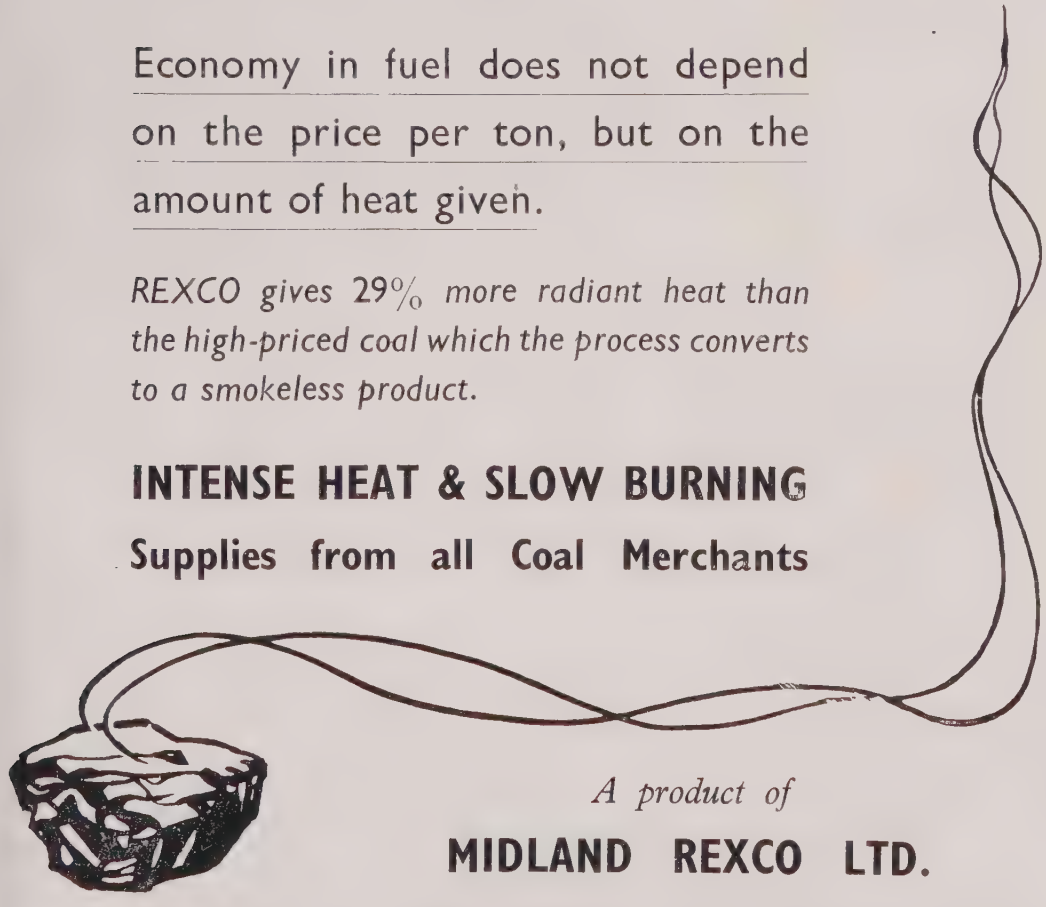
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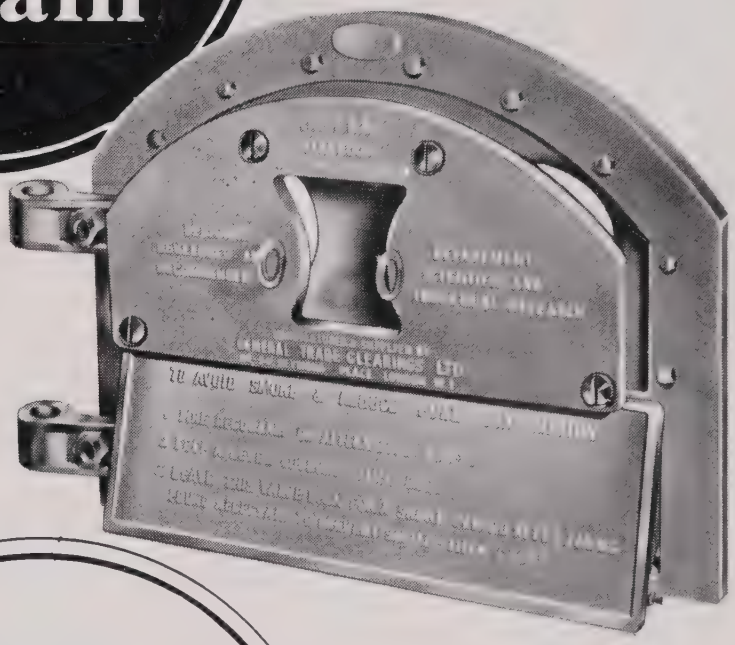
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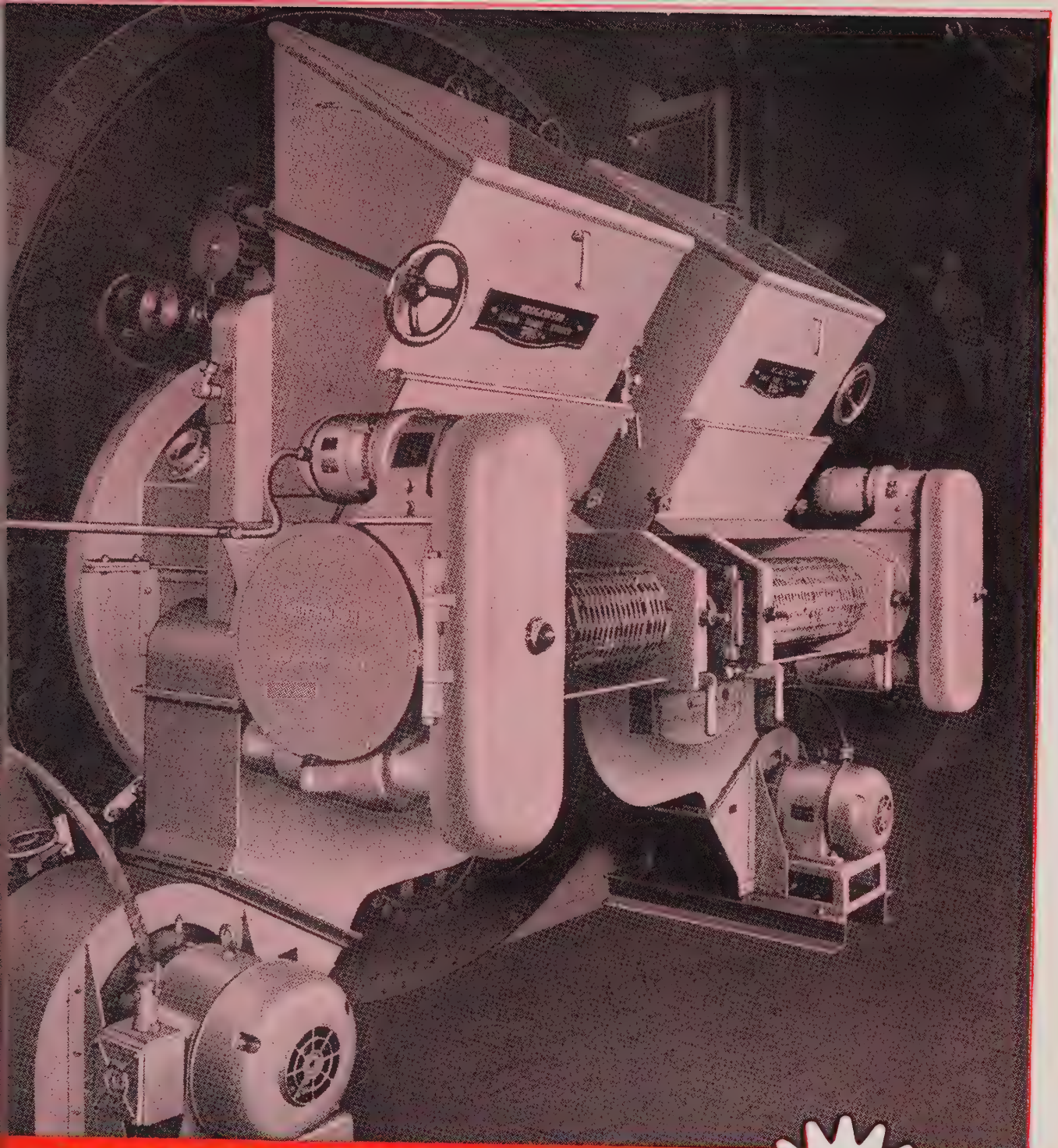
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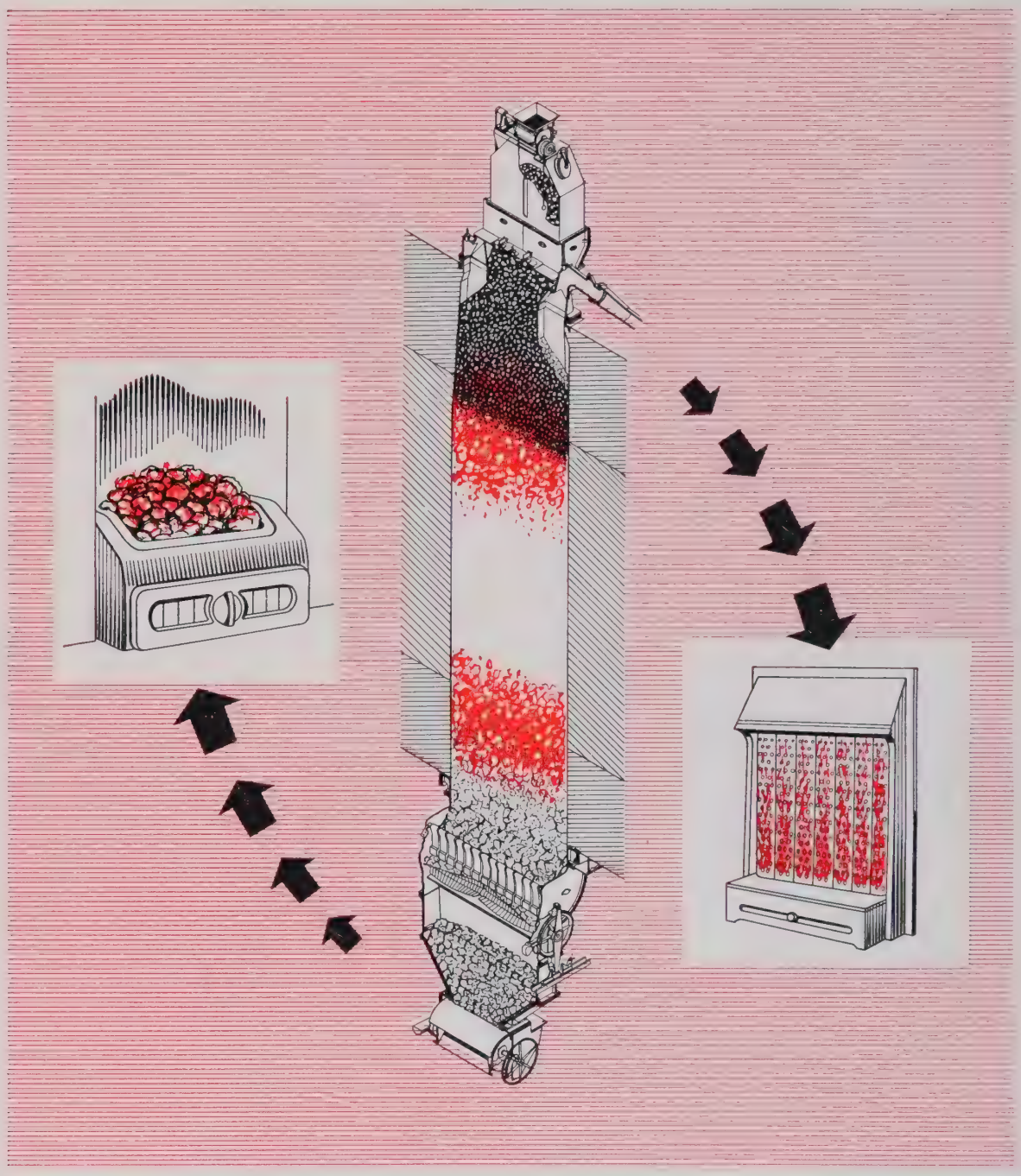
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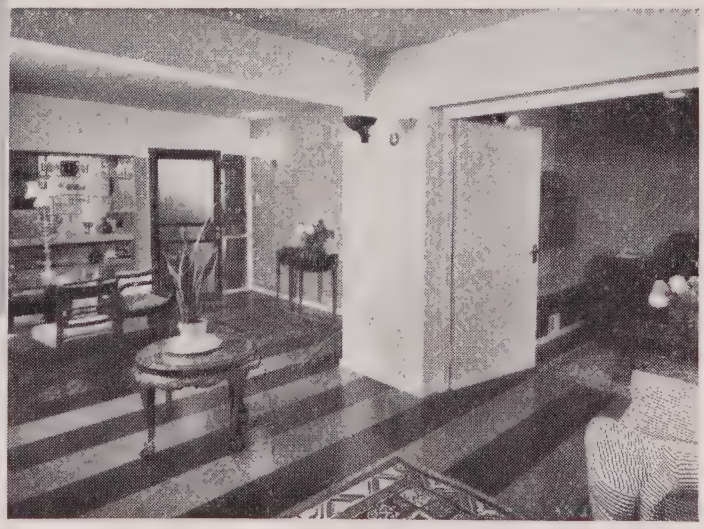
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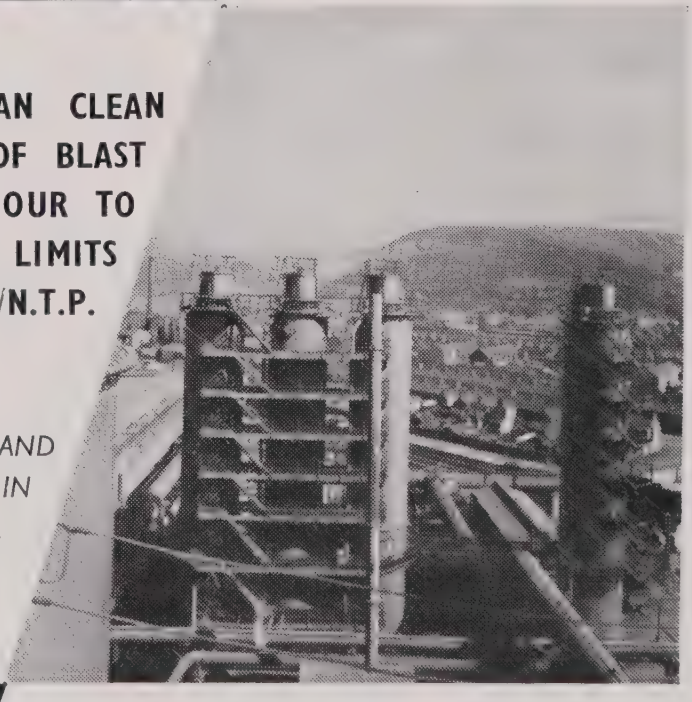
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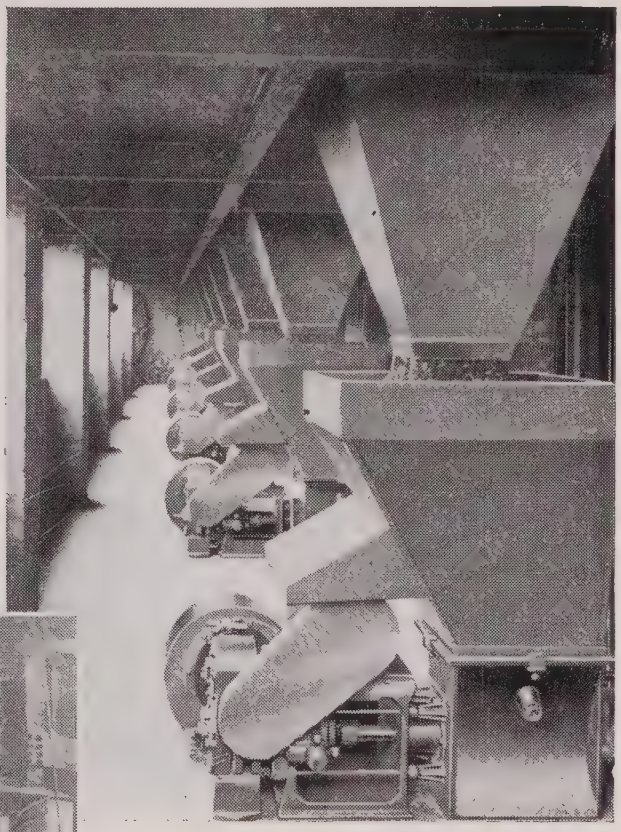
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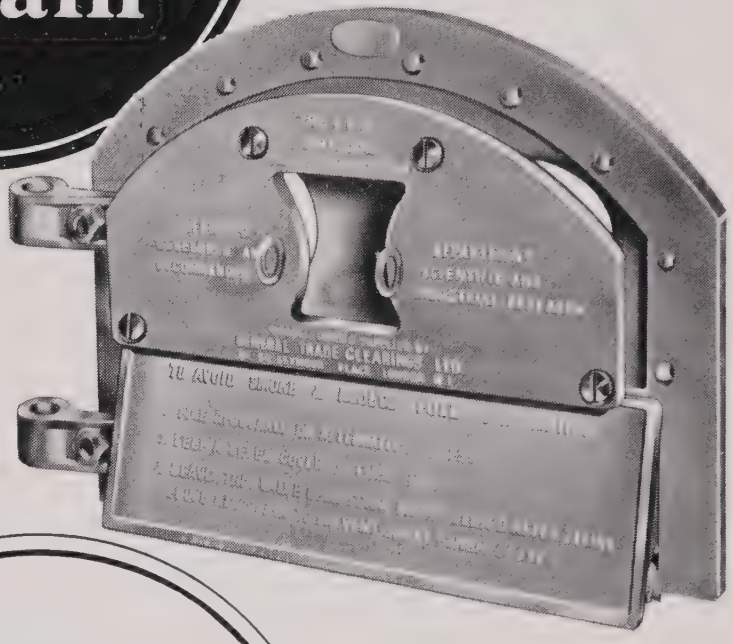
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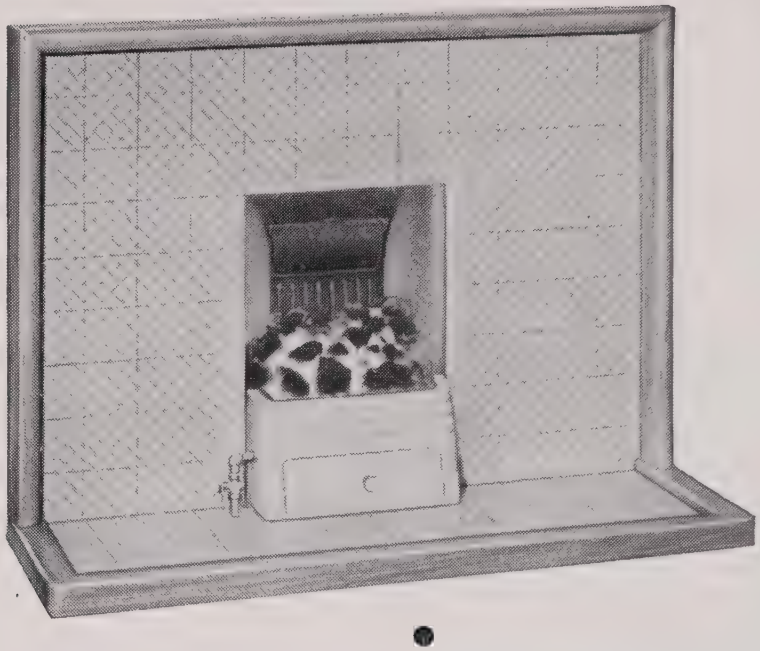
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SMOKELESS AIR

Vol XXV. No. 92 Winter, 1954

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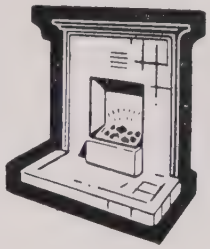
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SOLID SMOKELESS FUELS

The Solid Smokeless Fuels Federation

is a group of organisations responsible for practically the total production of solid smokeless fuels in Great Britain, amounting to 38,500,000 tons per annum. One of the main objects of the Federation is to ensure that solid smokeless fuels are used as efficiently as possible. The combined technical and scientific resources of the Federation, in association with appliance makers, are continually employed in developing high efficiency equipment both for the home and for industry.



The advantages of Solid Smokeless Fuels

Solid smokeless fuels give a *higher* proportion of *radiant* heat than household coal. Consequently you get more useful heat from approved domestic appliances at a *lower* cost for fuel.

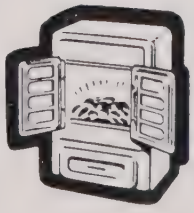
Appliances designed for solid smokeless fuels provide easy and accurate control of the rate of burning and heat output. This makes them extremely economical to run, and capable of long burning periods and overnight banking, thus saving work and attention.

Solid smokeless fuels are graded in a wide range of sizes and in a variety of types to ensure satisfactory performance in all domestic appliances.

Modern solid smokeless fuel appliances usually incorporate a built-in gas burner or gas poker. Lighting up is therefore simple, clean and convenient. No wood or paper is required.

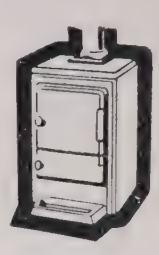
These fuels are smokeless and sootless. They save dirt and work in the home and help to keep house furnishings and paintwork clean.

Solid smokeless fuels are conducive to better atmospheric conditions and improved standards of health.



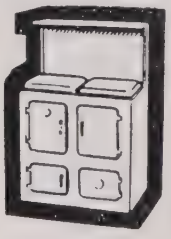
Which are the Solid Smokeless Fuels?

They comprise chiefly (1) the natural smokeless fuels, Welsh Anthracite and Dry Steam Coals, and (2) the manufactured smokeless fuels, Gas Coke, Hard Coke, Low Temperature Coke (''Coalite'' and Rexco) and Carbonised Ovoids. The natural fuels are obtained from underground coal seams. Both are dense fuels with a low ash content providing highly desirable long-burning properties. The manufactured fuels result from the carbonisation of coal in retorts or ovens, whereby the smoke-producing substance present, known as its ''volatile content'', is converted into gas and tar, the source of valuable by-products for use in home and industry. Carbonised Ovoids are marketed under the trade name of ''Phurnacite''. They have a uniform shape, a low ash content and are very similar in burning properties to Anthracite.



Smokeless Zones

Solid smokeless fuel appliances, because of their outstanding efficiency and fuel economy, are particularly suited to meet the requirements for heating services in Smokeless Zones. The S.S.F.F. offers free technical advice to local authorities who are considering the establishment of Smokeless Zones in their areas.



Abolish smoke with solid smokeless fuels and get better heating in the home

S.15

SOLID SMOKELESS FUELS FEDERATION, 74 Grosvenor Street, London, W.1



All bright and glittering in the smokeless air

SMOKELESS AIR

Post Beaver

THE Beaver Report is out and we are fortunately able to give an account of it in this issue. Its importance to the Society and all the Society stands for needs no emphasis. It is interesting and enlightening to compare it with the Newton Report of 1920. Although in its essentials the case against the pollution is the same, the proposals for action, in their scope and promise, show what an enormous advance has been made during the past quarter century in both the technical measures that can be applied and the climate of public opinion that is equally important. The only outcome of the Newton Report was the half-hearted and partly inoperative Smoke Abatement Act of 1926, and it now becomes the Society's task to do all it can to ensure that the Beaver Report is neither neglected nor watered down, but is acted upon with a sense of urgency.

This may well require the constant pressure of informed public opinion, which can be secured not by costly mass propaganda, but rather by the continued education and stimulation of the leaders of public opinion and those who will develop and administer the measures to be taken. This may be the most important and responsible phase of the Society's existence, past and future, but it is one which the Society is now well-equipped to under-

take, thanks to its representative, nation-wide membership and its long experience. The only shortcoming is that its resources are still so absurdly small for the job to be done. Using the new figures put forward in the Beaver Report we calculate that our present annual income is the cost of fifteen minutes' smoke.

Condition of Tenancy

One of the newer developments that is commended by the Beaver Committee is the creation of smokeless housing estates by making the use of smokeless fuels a condition of tenancy. The examples of Bradford and Nottingham are well-known and now the first such zone in the London area has been agreed to. This initiative comes from Woolwich, where the Council has recently *unanimously* agreed that a big redevelopment area —St. Mary's—in the heart of the town, will be made smokeless by this procedure. An interesting and significant sequel is that one of the large private property owners in the town has intimated that he intends to follow suit. Similar schemes are also being considered in Edinburgh and at Barking, Essex.

Bradford's Lead

The condition-of-tenancy smokeless areas in Bradford are to be followed by smokeless zones, under the provisions of the city's local Act of 1949. The Ministry of Housing and Local Government is reported to have confirmed an Order which prohibits the emission of smoke in no less than 20 zones, including the central area. This gives Bradford a long lead over the rest of the country, and Dr. John Douglas, the Medical Officer of Health, has said that when the zones are operating the city will have the largest acreage of smokeless zones in the country.

Many inquiries about the smokeless zones position are received by the Society and it is becoming less easy to keep track of everything that is happening. (It would be greatly appreciated if local authority officers among our readers would keep us informed of developments). Zones at present operating are in Coventry, Manchester, Rochdale and Bolton. Coming in the New Year are Tottenham and Salford.

The T.U.C. and Smoke

We have been pleased to see in *Labour*, the T.U.C. magazine (October, 1954) an outspoken article on smoke. It declares that " The Trades Union Congress has been among the eager advocates of a vigorous policy to clear the air of pollution and to stop the squandering of coal." It wants to see more smokeless zones, and " among the planks in the T.U.C. platform have been the need for higher standards of maintenance for fuel-burning equipment and the installation of modern plant where it is required." But we are sorry to note, there is no reference to one important advance in which the T.U.C. could do so much: the better training and certification of boiler and furnace men.

The Muck which Passes . . .

The Duke of Edinburgh, speaking at the recent dinner of the Institute of Fuel, said that the proper use of fuel could do a great deal in " cleaning up the muck which passes for fresh air in most of our cities." Nowadays we heard a lot about encouraging miners to produce more coal. It seemed to him that the best encouragement they could give to the miners was to let them see that fuel was not being wasted.

Two News Stories

1. Charged with six violations of an air pollution ordinance, the manager of the Mundet Cork Corporation Plant at Hillside, New Jersey, was sentenced to 180 days in jail and fined $600.

2. Fire completely destroyed a laundry in Lewis recently, ending a smoke nuisance that has been a

grievance for many years. The previous week " 43 tenants signed a petition to the Medical Officer of Health complaining, and the Town Council of Stornaway had decided to ask for an immediate remedy."

Sulphur

A summary is given on another page of the important conference recently organized by the Institute of Fuel for the purpose of discussing the many problems of sulphur in fuel. To muse on the situation is apt to produce odd trains of thought—

" What is this sulphur?" asked Alice, hurriedly putting down the technical journal she had picked up by mistake.

" It's a sort of yellow stuff we import from abroad," said the Red King, " and it costs us a pretty penny in dollars."

" What do we use it for?" persisted Alice.

" I can tell you that," broke in the Red Queen, knowledgeably. " It's the stuff that makes the nasty gas which dissolves cathedrals and curtains and all sorts of things—not to mention what it does in a smog."

" Nonsense," said the King. " The sulphur we use for dissolving things is the native sort we find in our coal. The foreign sort we use to *make* things."

" Wouldn't it be simpler," asked Alice innocently, " if we used the native sort to make things, and then we could save dollars and stop the cathedrals dissolving too?"

The King sighed. " That's what they are trying to do," he said patiently, " but it isn't easy to catch the stuff."

" And what's more," said the Queen " I've got a friend whose husband says that even if they do catch it any little bit they don't catch will make the cathedrals dissolve away faster than ever!"

" Oh dear!" said Alice, " It's all very confusing. Can't we talk about something else now?"

A Photo-Electric Fog Meter

A photo-electric fog or atmosphere meter has been developed in the U.S.A. for measuring and continuously recording the density of fog. In this country comparable instruments have been made for measuring the condition of the atmosphere in the Mersey Tunnel, and (developed by the British Iron and Steel Research Association) for the measurement of dust in blast furnace gas (see *British Steelmaker*, *March*, 1954). The U.S. meter records the density of fog or haze during the whole 24 hours.

The estimation of fog density, which is an important factor in the scientific study or fog and smog, has always been a matter of uncertainty, and will continue to be so while it is dependent on the human eye making observations, inevitably to some extent subjective, at intervals. We are assured that accurate continuously-recording instruments could be made in this country, and they would appear to be of considerable value to the further research that is needed into the problem of smog.

Ourselves

Comment in other periodicals about SMOKELESS AIR is usually concerned with the contents. For example, the " Origin of Smog " article in the last issue was noted in many quarters, and was reprinted in full in one journal. But sometimes it is our character that is discussed, and we have recently been pleased to note from one paper that we are " a fighting journal," which " is an accurate reflection of the fighting spirit of its sponsors." Another, rather more ambiguously, describes us as being " slightly bitter." Perhaps, of course, being a little bitter makes us fight the better?

Smokeless Air is full of useful information which it would be profitable for Capetonians to study.—*Leader in* CAPE NEWS, *South Africa.*

THE BEAVER REPORT

A Preliminary Review

THE Report of the Committee on Air Pollution (H.M.S.O., 2s. 6d.) is published just as this issue had to go to press, and the present notice does not therefore attempt to do more than to give first personal impressions and to mention some of the more outstanding points. There are few surprises, and in its essentials it can be said that the case for the prevention of air pollution, as it has been advocated by the N.S.A.S., has been audited and found correct.

The Report is an admirable document. The approach to the problem leaves nothing to be desired; the analysis is convincing and reveals a detailed and balanced study of the many factors involved; and finally the recommendations, with one or two exceptions that are likely to be criticized, are sound and politically practicable. All who are conversant with this many-sided problem of air pollution will sense the enormous amount of hard work, if not midnight oil, that must have been put into their task by the Chairman, Members, Assessors and Secretary in the space of little more than a year. They must be thanked and congratulated.

The attitude of the Committee to its inquiry is shown by the statement in the introduction: "We took little formal evidence; rather taking the view that all interests were in agreement as to the objective and that therefore it was a matter for joint discussion to find the means."

"In presenting this Report," says the Report, "we wish to state our emphatic belief that air pollution on the scale with which we are familiar in this country today is a social and economic evil which should no longer be tolerated, and that it needs to be combated with the same conviction and energy as were applied one hundred years ago in securing pure water. We are convinced that given the will it can be prevented. To do this will require a national effort and will entail costs and sacrifices; the recommendations made in this Report will involve expenditure by the Government, local authorities, industry and householders alike. But we are confident that our proposals, if carried out, will secure happier and more healthy living conditions for millions of people, and that on all counts the cost of the cure will be far less than the national loss in allowing the evil to continue."

Health and Cost

The effects of air pollution on health have been further studied and are usefully stated, and while the need for further medical research is stressed, it is said that:

"Action to reduce pollution by smoke, grit and dust and sulphur oxides need not, and must not, be held up while further medical research is done. There can be no doubt that the effect of air pollution on health is wholly bad, whether measured positively in relation to growth, well-being and joy of living, or more negatively in terms of death, disease and the economic loss which goes with incapacity to work."

This is well said, and is refreshingly outspoken in comparison with the aridity of another recent report.

It is in relation to the cost of air pollution that the Committee has gone further than had been previously ventured. The report of an inquiry into the economic cost by a subcommittee is given as an appendix and in this it is estimated that the annual cost to this country is £250 millions a year, not including the value of the fuel that goes to the making of smoke. This is much higher than any previous estimate, in which no doubt there has

been a desire to avoid a charge of propaganda exaggeration. The new figure can be accepted, and is of considerable importance, carrying as it does the *cachet* of so authoritative a source.

Legislation

Perhaps the most important part of the Report is the recommendations for new legislation. The weaknesses of the present law, which the Committee had impressed upon it by many bodies (including the Society) are admitted, and a new "Clean Air" Act is proposed. A summary may be attempted:

1. The emission of *dark* smoke (i.e., more than No. 2 Ringelmann) from any chimney to be prohibited.
2. Efficient grit arrestors to be obligatory in all new pulverized fuel plant and any plant burning more than 15 tons of coal per hour.
3. The processes listed in the present "exemption" clause (s.109 of the P.H. Act, 1936) with certain others (*e.g.*, power stations, gas works, ceramic works) to be placed under the control of an expanded Alkali Works Inspectorate.
4. Compulsory prior approval to apply to these scheduled processes, but voluntary prior approval (as in recent local legislation) to installations under local authority control.
5. The law relating to smoke and colliery spoilbanks to be brought up to date and made a responsibility of the local authorities.
6. General powers to create smokeless zones and a new type of "smoke control" areas (subject, as now under the local Acts, to Ministerial confirmation).
7. Financial assistance by local authorities and the Exchequer for domestic conversions.
8. All domestic heating appliances to be of approved types.
9. The present 50 per cent. purchase tax on gas and electric room and water heaters to be abolished.
10. Responsibility for enforcing the law (except the scheduled processes) to be a statutory duty of local authorities.
11. Local authorities to submit annual reports on smoke prevention to the appropriate Minister.
12. Penalties for offences to be increased. Quoted as an example, but without recommendation, are the present penalties for river pollution—£200 for a first offence; 6 months imprisonment and/or £500 for subsequent offences.

Other Recommendations

There are 15 other recommendations, all of importance. They include proposals for British Standards on smoke emission, smoke indicators and recorders, and methods of flue gas washing; the proper training of firemen; extension of the Government loan scheme to equipment for smoke prevention and allowing expenditure on such equipment to be charged against revenue for tax purposes in the year in which it is made.

Of considerable importance is the recommendation that all new power stations in or near populated areas should have sulphur washing plant. Railway smoke is considered and so is pollution from road vehicles.

The next recommendation must be quoted in full:

"The prevention of domestic smoke will require the replacement of bituminous coal now used in domestic premises in the 'black areas' by smokeless fuels, and also the provision of new appliances, fitted with easy means of ignition, in which such fuels can be burnt satisfactorily. This should be secured by the progressive extension of smokeless zones and smoke control areas as increased supplies of smokeless fuels are made available."

Next: "Clean air should be the declared national policy and it should be recognized by both the Government and the nationalized fuel industries as an essential element in fuel policy in the future."

Local authorities should employ adequate smoke control staffs with

proper training and technical qualifications, and " arrangements should be made to secure effective co-ordination between local authorities in the black areas and especially in Greater London."

Finally, what is termed a " Clean Air Council " should be established to co-ordinate and encourage research work and review the progress made in implementing any new legislation. The form of this body is left to be decided by Ministers. This recommendation is on the lines of that proposed by the Society in its Memorandum to the Committee, where it was said that the many matters that will arise when a vigorous clean air policy is adopted " and which will concern a number of Government departments, call for administrative arrangements (such as a standing committee for air pollution) to keep the problem under continuous review."

Smokeless Zones

The principle of the smokeless zone is said to be " admirable and effective " and such zones are envisaged as the means by which the progressive prevention of smoke can be achieved in the black areas. A new conception implied in the Society's Memorandum to the Committee (Appendix, Smokeless Zones, Para. 6) is that of the " smoke control area." Such areas, which might be much larger than smokeless zones, would be areas in which both houses and coal-burning industrial plant are situated. For industry the new legislative provisions would apply, and for domestic property only coal of not more than 20 per cent. volatile matter would be permitted. Little further is said, however, about the supply and distribution of such sub-bituminous coal, although the question of the true smokeless fuels is considered in much detail, and an excellent and very full analysis of the problem is given in an appendix by Dr. G. E. Foxwell. The conclusion reached—and it is called a firm conclusion—is that by full use of all the sources of supply that are discussed *the replacement of house coal throughout the black areas by coke and other smokeless means of heating is practicable.*

There are many other important matters considered in the Report, which cannot be referred to in the first survey of a document that will be discussed in the months to come from every possible angle. There are inevitably gaps here and there, a few disappointments, and an occasional sign of indecision or compromise; and no doubt more than one of the recommendations will come under fire from one quarter or another. But such points are of detail, and they cannot do much to lessen the immense value of the Report as the next phase of the campaign opens—*Implementation.*

To refer back from the Report to the Society's Memorandum to the Beaver Committee, and to compare the two is to appreciate how substantially the principles advanced by—and sometimes conceived by—the Society have been accepted and elaborated by the Committee.

Research work on a London bus diesel engine, being conducted at a cost of nearly £5,000 a year, to determine whether diesel exhaust gases are harmful, was seen by Mr. Geoffrey Lloyd, Minister of Fuel and Power, when he paid an informal visit to the Shell Company's Thornton research centre recently. Dr. C. B. Davies, research manager in charge of the laboratories, explaining that the first aim was to find ways of reducing, or even eliminating, the exhaust smoke, said: " We know it is unpleasant and that it may be harmful to health. Elimination is obviously the complete remedy. As this may not be possible we are also studying the density of the gases, and when that is done we shall analyse them with the aid of a smoke meter."



Scarborough

A SUCCESSFUL CONFERENCE

IT IS gratifying to those concerned with the planning and organization of the Society's conference to hear afterwards, as was the case after Scarborough this year, that "This was the best we've ever had." It was certainly the largest in attendance, with nearly 500 members and delegates. There was an increase in both the number of local authorities and other organizations represented.

The conference started well, with a welcome from the Mayor of Scarborough, Councillor Miles Bird, J.P., whose Yorkshire stories led to a Lancastrian response from the President, Sir Ernest Smith, who was in the Chair. Then followed Sir Ernest's first Presidential Address—an informative and stimulating survey of the Society's place in the revolution in the world of fuel that was in progress. In the afternoon the conference heard a first-class address by Sir Hugh Beaver, who, though he could not anticipate the findings of his Committee, showed clearly where his sympathies lay and in so doing greatly stimulated his audience.

Thursday saw the more technical sessions—in the morning a paper by Mr. R. F. Harvey, Chief Motive Power Officer, British Railways, on developments promoting smokelessness in railway locomotion, and in the afternoon a session on developments in the industrial uses of gas and electricity: two papers, one by Mr. R. F. Hayman of the Gas Council and the other by Mr. J. I. Bernard of the Electrical Development Association. At this session the Chairman was Dr. W. A. Macfarlane, Director of the National Industrial Fuel Efficiency Service, who in his remarks explained the purposes and functions of his



Sir Hugh Beaver
speaking at Scarborough

organization. At both sessions there were excellent contributions to the discussions. Perhaps one of the factors adding to the prestige of the Society's recent conference is the high level of interest and quality reached in the discussions.

After the morning session was a showing of the new Gas Council film "Guilty Chimneys"—which received a round of spontaneous applause at its conclusion—preceded by the new C.C.H.E. film strip on smoke, "Fog is Officially Forecast."

On the Thursday evening members of the conference were invited to a most enjoyable civic reception, at which the Deputy Mayor and Mayoress (Alderman and Mrs. Storry) of Scarborough were the hosts.

The Des Voeux Lecture came on Friday morning, with Sir Edward Salisbury, Director of Kew, as the lecturer, on Air Pollution and Plant Life. To appreciate the content of the lecture it is necessary to read it but only those who were present can appreciate the way in which it was delivered. In both respects it was of a high order.

The conference closed with the Annual General Meeting, at which the results of the annual elections were announced. Sir Ernest Smith was re-elected President, and two new Vice-Presidents are Dr. Harold Hartley, C.B.E., and Mr. T. C. Finlayson. Both are good friends of the Society on the industrial side, Dr. Hartley being Chairman of Radiation Ltd.,



The Platform at the Opening, left to right are: S. N. Duguid, F. J. Redstone, J. J. Matthews, Dr. R. Lessing, the Mayor of Scarborough, (Councillor Miles Bird), Sir Ernest Smith, Arnold Marsh, Dr. W. R. Martine and Ald. Prof. F. E. Tylecote

and Mr. Finlayson, Chairman of Woodall-Duckham's. At a meeting of the newly elected Executive Council during the conference Dr. W. R. Martine was re-elected Chairman.

The conference considered and passed only one resolution—proposed by Alderman Chapman of Newcastle with the backing of the Executive Council. It read thus:

> "That this Conference of the National Smoke Abatement Society calls upon the Minister of Housing and Local Government to promote early legislation granting permissive powers to local authorities to establish smokeless zones, thereby obviating the necessity for the promotion of private Bills."

The resolution has been duly submitted to the Minister of Housing and Local Government.

One of the purposes of the conference is of course to create interest among the public by the publicity it receives. We cannot complain of neglect by the Press, for there have been received a record number of cuttings—exceeding 500—while the B.B.C. gave several reports, including recorded extracts of Sir Hugh Beaver's speech.

There was, of course, the sad news to be given to the conference of the death, less than a week before, of the Society's recently promoted Secretary, Mr. Victor Silver, who had done a great deal of the organizational work and had been looking forward to the occasion with his unfailing zest.

It was announced that the 1955 conference will be held, by invitation of the Mayor and Council, in Bournemouth, on 28th to 30th September.

(NOTE.—*The Proceedings of the Scarborough Conference will shortly be published at 7s. 6d. Copies will be sent to all who attended the conference, without further charge, and full members of the Society, or their appointed representative, are entitled to receive a copy gratis, on making a request.*)

THE STANDING CONFERENCE ON ATMOSPHERIC POLLUTION

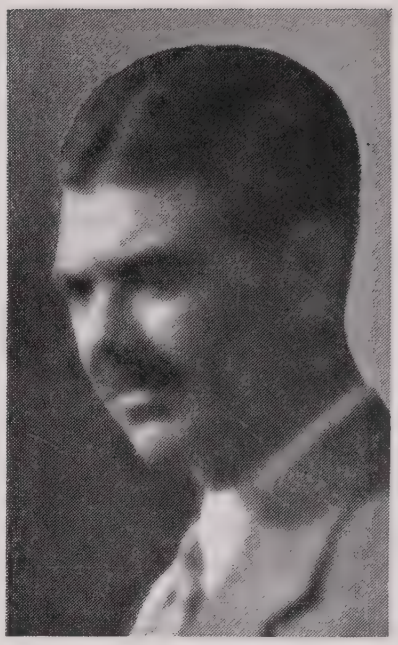
The Standing Conference on the Investigation of Atmospheric Pollution, which consists of representatives of the co-operating bodies, held a well-attended meeting in London on 8th November. It received a report from the Department of Scientific and Industrial Research, which through the Fuel Research Board, co-ordinates the investigation and carries out research. The report showed a further increase in the number of co-operating bodies, which now total 199, and in the instruments in use, which now total 1,482.

It was stated that the preparation of data for the report on observations made during the period 1944-54 was well advanced, and that it was hoped subsequently to revert to the pre-war practice of publishing annual reports.

Arrangements have been made in the London area for more frequent measurements to be taken during any severe and prolonged smogs in the present winter, and also for the "instantaneous" measurement of various pollutants during smogs by teams of Civil Defence volunteers, one hundred of whom are being trained to carry out the tests that have been devised for this purpose. Essentially, the method used consists in pumping known volumes of air through reagents, until a characteristic reaction occurs. For smoke, the air is pumped through a filter paper and the stain produced is compared with standards. The pollutants to be measured in this way are smoke, sulphur dioxide, other acids, hydrogen sulphide and carbon monoxide. A considerable amount of laboratory work has been necessary to perfect these tests and to make the necessary calibrations.

In the thickest fog of the winter, on 8th November, hundreds of starlings invaded the centre of Newton-le-Willows, south Lancashire, and by morning many were dead, apparently suffocated by the fog.

Victor R. Silver



V. R. Silver

It is with the deepest regret that we have to record the death, on 16th September, 1954, of the Society's Secretary, Victor Robert Silver. During holiday, being taken just before the conference he had done much to organize, he contracted a rare and painful virus infection, to which, despite all possible medical care, he succumbed after a fortnight's illness.

Mr. Silver joined the Society in 1945, after demobilization from the Army, in which he had served throughout the war, first as an anti-aircraft officer in this country, and then, with the rank of Captain, at G.H.Q. in India. He came to the Society at the time it was recovering from the ground lost during the war and was beginning the expansion in membership, activities and influence that has continued since then. At first as administrative officer, and then since last year in the position of Secretary, Mr. Silver gave to the Society a rare combination of loyalty, untiring interest, understanding and efficient, thoughtful work. Although he was primarily concerned with the business and organization sides, he gradually acquired a wide knowledge and insight, not only of air pollution and its ancillary subjects, but also of the less obvious but equally important problems of publicity and presentation, public and personal relations, and of the things in which understanding, patience and tact are needed.

As those who knew him well appreciate, he was of a frank and friendly personality, at all times fair and considerate, and his sudden, tragic loss has been felt in a very personal way, not only by members of the Society, but also by the many people he met on business matters for the Society—and above all, by his staff colleagues, to all of whom he was a genuine friend. He was a man of fine ideals and integrity.

He has left a widow and one son. His age was 44.

SIR EDWARD KEELING

It is with regret that we have to record the death, on 23rd November, 1954, after a short illness, of Sir Edward Keeling, M.C., Member of Parliament for Twickenham. Sir Edward, who was aged 66, was a Vice-President of the Society and President of the London and Home Counties Advisory Council for Smoke Abatement. He was one of the few members of Parliament to be consistently interested and active in smoke abatement. Sir Edward had many other interests, many relating to amenities, and had a distinguished career. His services and adventures in the Middle East during the first world war were notable, and were the subject of books he wrote between 1920 and 1924. He was parliamentary private secretary to the Minister of Labour in 1937, and afterwards to other Ministers, until he joined the Royal Air Force in 1939 and served in it for nearly six years.

SULPHUR

Conference on its Removal and Recovery from Fuels

THE recent Conference of The Institute of Fuel in London was attended by fuel technologists, engineers and scientists from this country and overseas, including representatives from Belgium, Denmark, France, Germany, Holland, Italy and Sweden. The proceedings were opened by Sir John Maud, K.C.B., C.B.E. (Permanent Secretary, Ministry of Fuel and Power), who was introduced by the President, Dr. W. Idris Jones, C.B.E.

Thirteen papers were presented by scientific authorities of wide experience in the removal and recovery of sulphur in specific industrial processes. The discussions, which ranged over a wide field, were summarized at the close of the Conference by the official Rapporteur, Dr. J. G. King, O.B.E.

The following general conclusions, taken from Dr. King's summary, were endorsed by the Conference.

(1) The main source of indigenous sulphur is that contained in our coal. This amounts to over 3 million tons per annum and we now recover only 5 to 6 per cent of it. Sulphur in petroleum represents another 600,000 tons and we are aiming to recover only 5 per cent of that.

(2) The recovery of a higher proportion is essential for reasons of national economy, since we now import 75 per cent of our sulphur requirements. Action is made more pressing (*a*) by the deleterious effects of sulphur in industrial processes, particularly metallurgy and glass; and (*b*) by injury to buildings, plants and human health by oxides of sulphur emitted to the atmosphere.

(3) Sulphur in the coal seam is rising slowly and in fuel oil has risen markedly, and every effort must be made to find means of reducing sulphur content after mining the coal or before marketing the oil in such a manner that recovery in usable form is possible. The industrial value of a lower sulphur content of fuel to industry is not clearly defined and some definition should be attempted in order to assess the possible value of removal processes, since these are likely to be expensive. Coal of high caking power and low sulphur content may have to be reserved, or medium-sulphur-content coal cleaned, to provide low-sulphur coal to the iron and steel industries. Unless fuel oils can be reduced in sulphur content, this will impose some limitation of usage in processes where sulphur is a difficult factor.

(4) The gas industry now recovers 40 per cent of the sulphur of its coal by effective means. A number of large-scale flow methods are now available but there are doubts as to their suitability for British conditions and as to their operating costs. They will remove 70 to 80 per cent of the hydrogen sulphide from gas, but the real consideration is whether any process can be worked in a given environment so as to produce by-product sulphuric acid or sulphur on an economic basis. The cleaning of coke-oven gas not now cleaned could add 60 per cent to the gas industry's contribution to indigenous sulphur.

(5) Combustion gases from very large power stations are a potentially large source of sulphur of which effective recovery is more than desirable, as well as its removal from the atmosphere.

(6) It is regrettable that no new indigenous source of sulphur has been disclosed by the Conference, but the papers have focused interest so strongly on existing methods of recovery that this surely must give added impetus to further industrial action.

THE DIVISIONS

NORTH WEST

Some changes in the pattern of fuel consumption in the United States—and especially the diminishing share taken by coal as a source of heat and energy—were described by Dr. W. A. Macfarlane, chief executive of the National Industrial Fuel Efficiency Service, when he addressed a joint meeting of the North-western sections of the Institute of Fuel and the National Smoke Abatement Society at the Engineers' Club, Manchester, recently. In 1900 over 90 per cent. of the fuel consumed was coal, whereas in 1950 the proportion was well below half, and was still diminishing.

Two large markets, he said, had been lost to coal. For domestic heating natural gas was such an attractive fuel that in any part of the country where it was available it had become inevitable for newly-built houses. Domestic consumption of natural gas trebled between 1940 and 1952, by when it had risen to 15,000 million therms, equivalent to 90,000,000 tons of coal.

The railway market also had been largely lost to coal. Every major railway company except one had ceased the manufacture of steam locomotives. The main competition came from the diesel engine, and the efforts of the coal industry to retain the market had been directed chiefly to securing the electrification of the railways. "More and more," Dr. Macfarlane said, "has the coal industry come to look upon its rôle in the future as the supplier of raw material for electricity."

NORTH EAST

A well-attended annual meeting of the Division was held in King's College, Newcastle upon Tyne, on 15th October, 1954. Professor Cassie, of the Department of Civil Engineering introduced the Rector of King's College, Dr. C. I. C. Bosanquet, who welcomed the delegates. In the absence of Alderman Chapman, because of illness, the Chair at the morning business meeting was taken by Dr. J. Tilley, Northumberland County. Mr. Tate, the Hon. Secretary, reported on the latest position relating to meetings of the Division, and after discussion the following resolution was passed:

"That the North East Divisional Council of the National Smoke Abatement Society at its annual meeting in Newcastle upon Tyne on 15th October, 1954, expresses its strong disapproval of the action of the Minister of Housing and Local Government, in continuing to enforce the restriction on meetings of this North East Divisional Council.

At the afternoon session, with Alderman A. J. Best, of Darlington in the chair, a paper was read by Mr. Peter C. G. Isaac, Lecturer in Public Health Engineering at King's College, on "The Effects, Measurements and Control of the Atmospheric Pollution due to Combustion." The paper was most informative and stimulated a full discussion and questions. Members were afterwards the guests of the Department for afternoon tea.

The papers on *The Heat Pump* and *District Heating*, by our member Mr. V. A. Carpenter, previously noted in this journal, have now been published together as No. 32 of the series Modern Science Memoirs, published for the Science Masters' Association by John Murray. The price is 2s.

Mr. Lancelot Joynson-Hicks, M.P., Parliamentary Secretary to the Minister of Fuel and Power, at the annual luncheon of the British Coal Utilization Research Association in London recently, said some things about smoke that showed a keen personal interest in the problem. One well-made point in particular should be recorded:

"I would claim that the women of England are the cleanest and thriftiest in the world, yet they spend money to create smoke and dirt to such an extent that it seems to have become a national pastime."

Sanitary Reform and Smoke Abatement

By B. H. Wormsley, Ph.D.

" Air pollution . . . needs to be combated with the same conviction and energy as were applied one hundred years ago in securing pure water."
The Beaver Report

THERE is a close parallel between the last century's efforts to improve sanitary conditions and our attempts to diminish the pollution of the air. The nature and consequences of the two evils are similar; the problems to be solved are of the same kind; and the obstacles to be overcome before clean air becomes a reality are almost identical to those which confronted the sanitary pioneers 120 years ago. A study of sanitary reform holds many lessons for those concerned with smoke abatement.

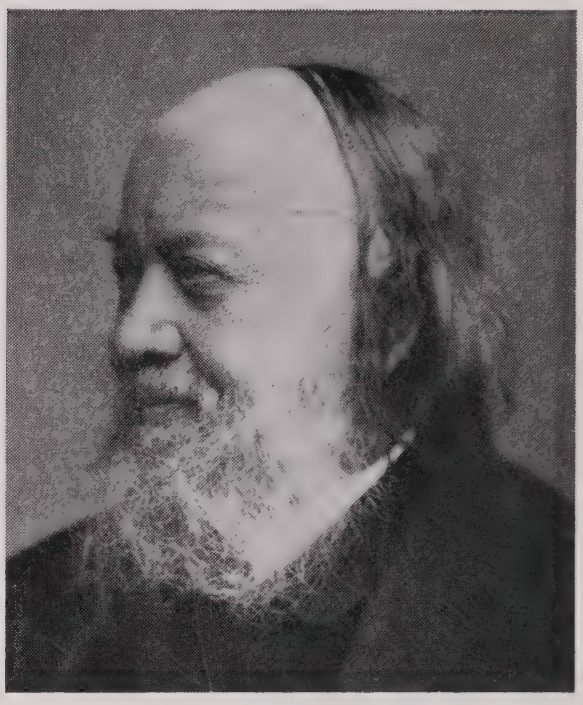
During the first half of the nineteenth century the sanitary conditions of the poor deteriorated from bad to quite incredibly worse. The growth of urban population rapidly outpaced the provision of houses, drainage, and water supply: the resulting environment of filth and stench in which the working class lived gave rise to perpetual disease and periodic epidemics.

The urge of the reformers to improve these conditions had two essential motives. In the first place, the powerful religious revival led to a growth of philanthropic sentiments, personified in reformers such as Lord Shaftsbury, and in a different field, Wilberforce. And in addition, the dominating motive of private profit was called into play when it was emphasized by Chadwick that " the expense [of sanitary improvements] would be a pecuniary gain, by diminishing the existing charges attendant on sickness and premature mortality."

The first task which faced the sanitary reformers was to make the public aware of the existing evils, and to crystallize public opinion in favour of remedial action. In this they were fortunate in having in their ranks the forceful and aggressive personality of Edwin Chadwick, the agitator, advocate, and persistent exposer of abuses. His disclosures were widely disseminated by a host of propagandists, including Dickens, Kingsley, and other famous novelists, who played on the literary hunger of the age to consolidate the impression. Then powerful pressure groups, such as the Health in Towns Association, whose membership reads like a page of Debrett, and which included the rising young politician D'Israeli, forced the government to recognize that what had been socially desirable had become politically expedient. Subsequently came the skilled and devoted administrators, such as Sir John Simon, (1816-1904) whose tactful implementation of the first tentative enactments gave the public a desire for more forthright measures. But perhaps the most important mouthpiece and ally of the reformers was one of the worst evils—the occasional epidemic. Wealth, power, and privilege could to some extent insulate itself against the chronic disease and misery of the poor, but cholera knew no social bounderies. Practically every serious epidemic during the last century was followed by some major piece of sanitary legislation meant to ameliorate the living conditions of the poor, and so reduce the likelihood of future catastrophe.

Today we face a similar problem with atmospheric pollution. Many feel that it is entirely reprehensible

that a large section of the population should have to spend their lives under a perpetual pall of smoke and grit. It is realized by some that it would probably be more economic to eliminate the atmospheric pollutants than to continue to suffer them. But as yet only a small minority realize the urgent necessity for cleaner air. There is a vital need for personalities and organizations and pressure groups to work to create, confirm and finally consolidate public opinion in favour of clean air. In this field there is already one important organization: the National Smoke Abatement Society, but further support is required. It should not be necessary to have to rely on lethal disasters, such as the 1952 London smog, to mobilize this support.



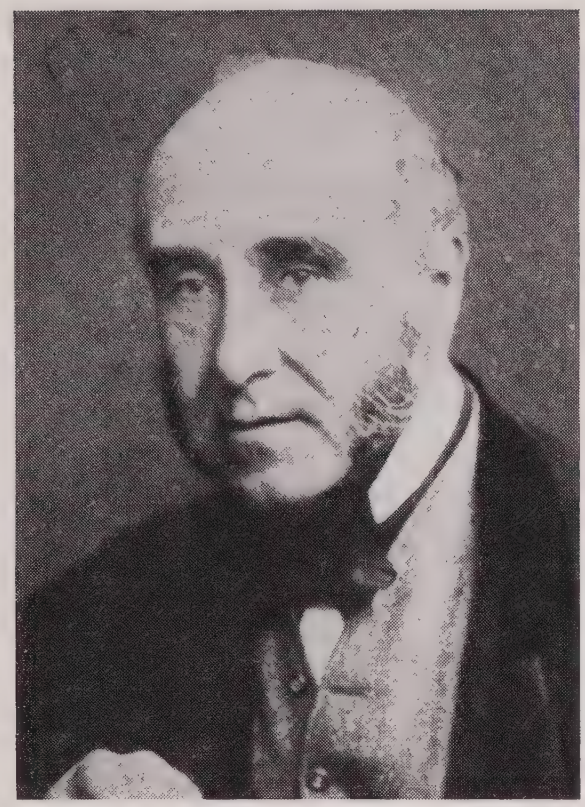
Sir Edwin Chadwick
1800–90
Social reformer and statistician. Author of " Report on the Sanitary Condition of the Labouring Population of Great Britain (1842)"

Administrative Framework for Sanitary Reform

In itself, however, the slow creation of public sympathy for the aims of the sanitary reformers was not sufficient: the tools to work the change had still to be forged. It was necessary to create a new administrative framework, develop new scientific principles and technical knowledge, and bring into being entirely new professions, before progress could be made.

In the administrative field it took some 30 years for a reasonably competent organization to be set up. The first important sanitary enactment—the Public Health Act of 1848—found local authorities, for the most part, either unwilling or unable to implement its essentially permissive clauses. The unwillingness sprang from the clash of interests between the powerful ratepayers controlling the local authorities, who wanted to keep the rates low, and the sanitary reformers whose public works would, in the first place, increase the burden of local debt. The inability to carry out the provisions of the Act was a direct consequence of the fragmentation of responsibility for administering sanitary measures. For instance, in 1847 in Metropolitan London, outside the City, there were no less than 300 sanitary authorities, each with overlapping responsibilities, and each clinging with determination to its own segment of power and privilege.

As long as a series of permissive sanitary acts was being passed, no great difficulty arose, because those authorities which were imbued with enthusiasm for reform managed to work out a means to their salvation, whilst the others fell by the wayside, unnoticed. But in 1866, the sanitary reformers felt that all local authorities should be forced to carry out certain sanitary functions, and as Sir John Simon elegantly put it, " the grammar of sanitary legislation acquired the novel virtue of the imperative mood." The law, which had been added to and amended for 18 years, was imprecise, incomplete and generally inconsistent; local authorities were inefficient and corrupt; it was therefore not surprising that by 1869 the administration of the 1866 Act was " incoherent to the point of chaos." It was during the 1870's that the administration caught up the reform-



Sir John Simon
1816–1904
Surgeon and sanitary reformer. First Medical Officer, City of London and first Medical Officer to the Local Government Board

ers' zeal, as a rapid succession of Acts divided the country into areas each being the responsibility of a single sanitary authority whose duties and powers were closely defined, and controlled by a central authority. It was not until this consolidation and simplification of the administrative framework that the greatest sanitary reforms were achieved.

Once again this has an exact bearing on present efforts to reduce atmospheric pollution. In the past, despite the inclusion of black smoke as a statutory nuisance in the 1875 Public Health Act, the law has rarely been enforced with vigour because local authorities have not been compelled to do so. And the law itself is so vague as to the definition of a smoke nuisance, and so full of exceptions and escape clauses, that its rigid administration is quite impossible. The history of the administration of the sanitary laws suggests that before much progress can be made towards cleaner air, the duties and powers of the relevant local authorities must be greatly increased and more closely defined, and provision must be made to ensure that these powers are used to the full.

Scientific and Technical Progress

To the early sanitary reformers most bodily ills could be attributed to dirt in one form or another; mankind could be cured of its diseases by providing an adequate and clean water supply, sound drainage and proper sewage disposal. There was no scientific basis for this belief—it was the result of the melancholy observation that where there was filth there was disease. Long before Pasteur and Koch had convinced the world as to the nature of disease and its method of transmission, Chadwick and Simon were suggesting and putting into effect the preventive methods which are the basis of preventive medicine today. There is a most important lesson to be learnt from this: that correct principles of action can be laid down before fully understanding the nature of the evil which is being fought. Good sense and perception are often sufficient to indicate the right means of attack.

However, at the beginning of the period of reform, a knowledge of what needed to be done would not have been enough to ensure progress. Technical knowledge was not sufficient to implement the canons of public health: clean water, adequate drains, proper sewage treatment. However, no difficulty or significant time lag was encountered in developing the relevant materials, products or techniques whenever they were required, provided that the particular problem could be solved using as a basis the existing scientific knowledge. It was only in one field—sewage treatment—that technical innovations did not keep pace with the reformers' zeal. It was not until considerably later, after Pasteur had laid the foundations of the science of fermentation, that suitable processes were evolved.

The relevance of all this to the

problem of atmospheric pollution is clear. There is no need to wait until the mechanism by which dirty air affects public welfare is known, before attacking the evil. That it is detrimental to health and good living is beyond doubt, and no one can question that the elimination of the pollutants from the air would be entirely beneficial. Action is called for now: later we will know how right we were to have undertaken the task.

There need be no delay in eliminating smoke and grit from the air because of a lack of technical knowledge of methods or products. The basic principles of smokeless combustion, grit arrestion, and smokeless fuel production are sufficiently well known to support any programme of smoke reduction. It is only in two fields that the basic principles need to be further extended for clean air purposes, namely, in the elimination of sulphur compounds from the products of combustion of fuels, and in the utilization of low rank coals in the production of cheap, smokeless fuels. When these problems have been overcome, there will be no technical justification for any pollution of the air.

Personnel Problems of Sanitary Reform

Concurrently with the development of the administrative framework and technical knowledge, there arose a need for specially skilled men to introduce and direct the new sanitary arrangements. Existing professions were generally unable to supply the skills required: what was wanted were specialists in preventive medicine to deal with local health problems, and experts in sanitary arrangements competent to investigate all potential nuisances and advise on their prevention.

The need for these skills was recognized right from the start of the period of reform. Chadwick, in his epic Report on the Sanitary Condition of the Labouring Population of Great Britain, pointed out that "it would be good economy to appoint a district medical officer . . . . with the securities of special qualifications and responsibilities to initiate sanitary measures." The first such medical officer, a local doctor who had shown considerable interest in preventive medicine, was appointed in Liverpool in 1847. The 1848 Public Health Act gave local Boards of Health discretion to appoint a qualified medical practitioner as full or part time local medical officer of health. These discretionary powers were not, in themselves, always sufficient to ensure that local authorities engaged the necessary staff, so in 1872, a Public Health Act was passed making such appointments compulsory. To start with, the Act was frustrated in its design since there were simply not enough doctors with a training in preventive medicine to fill the new positions. However, this unsatisfactory situation brought about its own solution. In 1870 the first course in public health was initiated at Trinity College, Dublin, and with the heavy demands for additional specialists, a similar course was started in Cambridge in 1875, and was widely copied elsewhere. By 1891, 27 metropolitan and 64 provincial sanitary authorities required their medical officer to hold a diploma in public health.

In a similar way, the demand for the stricter enforcement of the extending sanitary legislation created the need for specialist inspectors. A year after the great Public Health Act of 1875, the Sanitary Institute of Great Britain (now the Royal Sanitary Institute) was founded, with one of its aims to obtain a charter for the purpose of examining and granting certificates of qualification to sanitary inspectors. The first such certificates were granted in 1877.

It is noteworthy that the drastic revision of the legislative and administrative framework of public health brought in its train the formation of a core of highly trained specialists who played the essential rôle in implementing the new provisions. With these novel skills at hand, it is not surprising that the sanitary enactments of the 1870's, unlike their

predecessors, were eminently successful in rapidly improving the environmental conditions of the poor.

Seeing the importance of qualified experts in implementing a reform, it seems pertinent to wonder whether the training and qualifications of the men at present responsible for limiting smoke nuisances would enable them to exploit fully any more stringent clean air legislation which may be introduced.

At present local sanitary inspectors are responsible for the prevention of smoke nuisances. In the majority of cases the training of these inspectors places little emphasis on smoke prevention, and no practical experience of boiler or furnace operation is included. Some sanitary inspectors undertake a further period of part time study on some aspects of fuel technology, which enables them, upon passing an examination, to qualify as smoke inspectors. But even such inspectors would tend to lack the practical experience of industrial installations, and the knowledge of the complexities of combustion processes, which would enable them always to give sound advice and take correct action to prevent smoke pollution.

The essential point is that a smoke inspector should be an expert fuel technologist, and that if he is to devote his complete attention to smoke prevention it is unreasonable to expect him previously to have devoted his time and resources to learning the quite irrelevant sanitary techniques. His training need only include the theory and practice of fuel combustion, and other problems relevant to atmospheric pollution. There may well be scope for an institute, (analagous to the Royal Sanitary Institute) devoted entirely to atmospheric pollution problems, with powers to hold examinations and grant certificates to smoke inspectors, besides incidently furthering the knowledge of the subject, promoting clean air legislation, and calling public attention to the evils of atmospheric pollution and the economies which would result from its suppression.

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The S.I.A. Conference

The annual conference of the Sanitary Inspectors' Association in September last heard two papers on air pollution. Mr. Alfred Wade, M.B.E., Chief Sanitary Inspector, Nottingham, and Hon. Secretary of the East Midlands Division of the N.S.A.S read one of the papers, in the course of which he declared that almost everything that could be said about air pollution had been said and that it was now time for action. The second paper was by Mr. Edward Bayley, Deputy Chief Sanitary Inspector, Walsall, on the industrial sources of pollution.

The American Society of Mechanical Engineers is to hold an International Air Pollution Meeting in New York on 1st and 2nd March, 1955. It is announced that Sir Hugh Beaver will attend and will present the Institution's annual Calvin W. Rice Lecture.

W. C. L. Hemeon, engineering director of the Industrial Hygiene Foundation of America, addressing the American Chemical Society recently, said that the dangerous thing in smog seems to be acidic salts, usually sulphates and chlorides of ammonia, combined with zinc and other metals. The sulphur came from coal smoke. He expressed the belief that deaths and illness from severe smogs probably came from simple irritation of the breathing apparatus by such substances and were not due to poisoning by sulphur dioxide and other gases in the air. In a new analysis of samples of air saved from the Donora and London smog disasters water-soluble particles of less than 1/5,000th of an inch in diameter were studied. About 20 per cent of the particles from the Donora air would dissolve in water, and 58 per cent of this soluble material apparently contained metallic ammonium sulphates.

New Publications

The Gas Council: Fifth Report and Accounts, 1953-54. 8vo., pp. 214, H.M.S.O. 6s. 6d. net

This report is divided into two sections. The first section deals briefly, but most clearly, with the activities of the Gas Council during the period 1949-54, while the second section deals with the year 1953-54 in some detail. The last hundred pages of the report are devoted to the accounts, and to a statistical analysis of income, expenditure, coal stocks, coke and gas sales, and other materials for Area Boards and for the Council.

The total gas sales were 0.4 per cent. lower in 1953-54 than in 1952-53, due probably to the close correlation between gas sales and temperature. Until the end of December, the weather was mild, and sales were low, but in the very cold week ending 7th February, 1954, 11 per cent. more gas was supplied than ever before. The reduction in annual sales was due entirely to the slackening of domestic and commercial demand, every Area Board showing an increase in the industrial demand for gas. In the West Midlands area, as much as 50 per cent. of total sales went to industrial consumers.

Another interesting point is the great increase in the number of appliances sold. Although this is not entirely due to the removal of hire purchase restrictions—receipts from cash sales are up by nearly £700,000—this has had a profound effect, as shown by the increase of sales by hire purchase from £15 million to more than £20 million.

Despite the roughly constant level of gas sales, coke production was down by 209 thousand tons compared with the previous year. Over the whole year, the demand in the home market increased, but on the export market there was a decrease of over 10 per cent. As for gas consumption, coke sales are closely correlated with temperature, and there is an interesting table of the number of " degree days " for the months October-March, together with a description of the trend of coke sales.

Those interested in smoke abatement will be glad to see that a start has been made towards the rationalization of the price structure for domestic sales of gas coke, a greatly simplified price scheme having been inaugurated in five of the southern areas. Similar schemes are in the course of preparation for the whole country. Two other important developments are the inauguration of a free advisory service in connection with the abovementioned schemes, and the issue of the 4th edition of the Approved Coke-Burning Domestic Appliances *Handbook*. Since it was first issued in June, 1953, 40 new appliances have been tested and approved for inclusion.

The report certainly seems to bear out the Council's claim that this fifth year has been one of development, compared with the preceding years of preparation and transition.

British Electricity Authority: Sixth Report and Accounts, 1953-54. 252 pp. 61 pp. Appendices. 8 plates. H.M.S.O 9s. net.

This Report provides evidence of another year of steady progress in the electricity supply industry. More than 66,000 million units of electricity were generated during the year—an increase of 7.3 per cent. compared with 1952-53—and the electricity sold amounted to over 55,800 million units —an increase of 6.9 per cent. Since vesting day, the number of consumers has increased by more than two and a half million (nearly 23 per cent.) and last year's contribution to this increase was 529,500 (3.8 per cent.).

Despite the restrictions on large scale building projects in the post-war period, the maximum output capacity has increased by 50 per cent., com-

pared with that existing on vesting day, 1st April, 1948. This has meant that many of the older generating plants, which are small and expensive to operate, have been retained in commission. In spite of this, however, the price per unit of electricity is only 30 per cent. above pre-war (1.37 pence in 1954 compared with 1.06 pence in 1937-38). This obviously means a considerable reduction in terms of real cost.

The report devotes seven paragraphs to the problem of air pollution, pointing out that the Authority is the largest individual consumer of coal in Great Britain—over 36 million tons were burnt in 1953-54. Since most of this coal is of poor quality, the prevention of pollution presents great difficulties. About £3 million a year is said to be spent on the installation of new grit arresting plant in new power stations, and steps have also been taken at older stations. An experiment has been conducted at St. Neots to measure dust deposited from the Little Barford power station, and the results are said to be excellent. It would be of considerable interest if the figures could be published in an appropriate form.

The expansion in output has been accompanied by a reduction in the number of employees per thousand kilowatts. The average figures were 2.69 on vesting day, and 2.20 in 1953-54.

" Trees in Towns," by Ronald J. Morling, A.M.T.P.I., A.I.L.A. The Estates Gazette Ltd. 79 pp., 14 plates. 7s. 6d. net.

This is an informative and most useful little book. It is well written and attractively produced, and in a small compass the author has managed to convey a good deal of information which would be difficult to find elsewhere. The book is comprehensively indexed, and there is a good bibliography. In the chapter on " Trees for Industrial Localities," the effects of atmospheric pollution are clearly explained, and in another chapter the purposes of Tree Preservation Orders are well described. A chapter on " Selected Lists of Trees " will be found not the least useful in the book. The author classifies the trees which can be used for various purposes in different kinds of area. While town planners and members of local authorities will find it invaluable, it will be read with interest by all tree-lovers.

" Dust is Dangerous," by C. N. Davies, D.Sc. (foreword by Sir George Barnett, H.M. Chief Inspector of Factories). 116 pp., 30 plates, 23 diagrams. Faber and Faber. 21s. net.

This book, by a well known research worker, is a good, non-technical appraisal of the dangers of dust. The deleterious effects on the human body of dust, smoke and noxious chemicals are described in simple language, illustrated by some excellent plates. Various methods of dust sampling are described, and the efficiency of a number of preventive measures is discussed. An interesting and topical chapter deals with the problem of radio-active dusts while another deals with the bane of the housewife—dust in the home. The last chapter underlines the need for scrupulous cleanliness in workrooms and factories if serious dust explosions are to be avoided. " A uniform layer of dust, only a few hundredths of an inch thick can . . . . form a dangerously explosive cloud."

The book is well indexed, and there is an extensive bioliography.

Fuel Research, 1953. (pp. 62, H.M.S.O., 2s. 6d.). The annual report on Fuel Research, published by the D.S.I.R., contains a great deal of important information on matters relating to air pollution—from coal carbonization to boilers and steam-raising, and from domestic heating investigations to the work being done on atmospheric pollution itself.

William Murdoch

Pioneer of Scientific Coal Utilization

A Bi-centenary Appreciation, by I. Berkovitch,
M.Sc. (TECH.), A.R.I.C.

WILLIAM MURDOCH—variously described as "The Founder of the Gas Industry," "The greatest mechanically inventive genius that Scotland has ever produced"—was born two hundred years ago, on the 21st August, 1754. His scientific interests were of the most varied and diverse character—and with Murdoch, "interest" was very soon transformed into discovery and invention.

What is his special significance to readers of this journal?

The evolution of gas from heated coal had already been noticed before Murdoch's time. For example, in the process of coke and tar making at Lord Dundonald's ovens at Culross, it had been observed that large volumes of gas were produced. But it was the genius of Murdoch to conceive the idea of applying this coal gas as a substitute for oils and tallow.

In 1792 he lighted his house and offices at Redruth in Cornwall with gas generated in an iron retort in the back-yard. Following this, he turned for a while to producing a number of mechanical inventions. But his enthusiasm for the use of coal-gas revived on hearing of experiments in France on the use of gas produced by carbonizing wood. He therefore began to investigate the gas-producing properties of various coals as well as the construction of retorts, pipes, gasometers, burners and other accessories to gas-making. Eventually, his apparatus was installed at the cotton mill of Messrs. Phillips and Lee of Manchester.

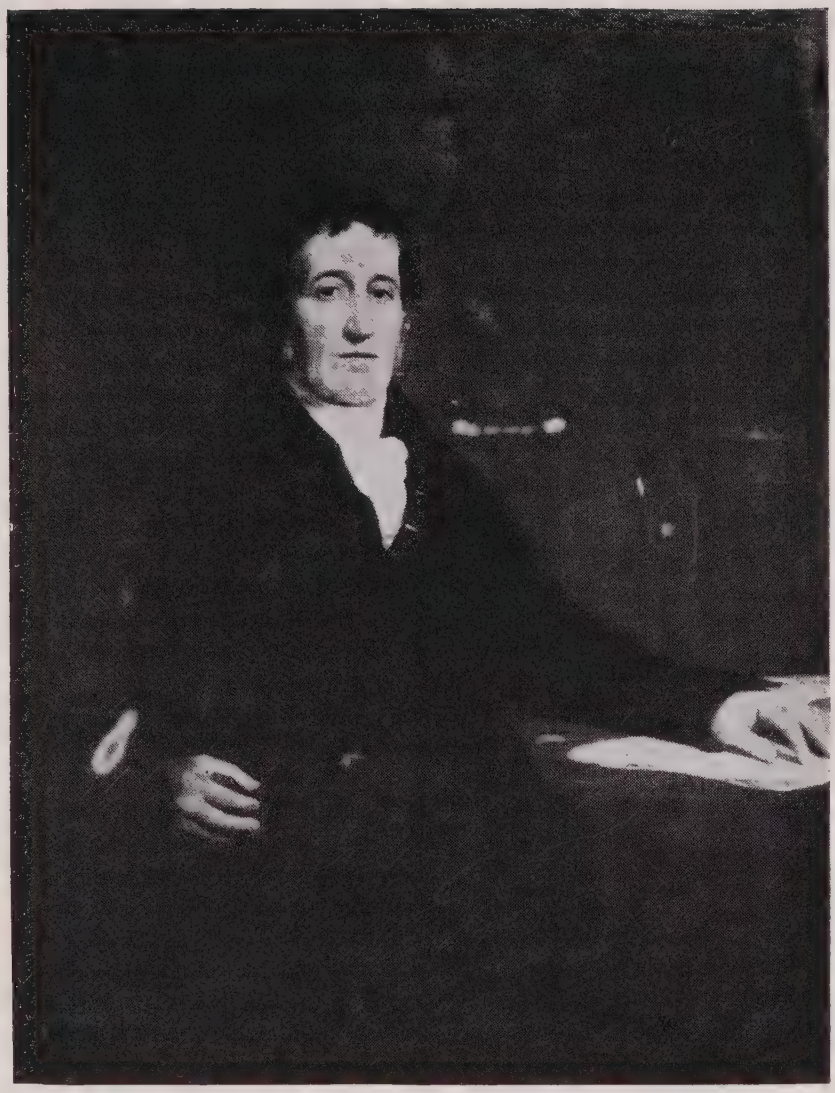
This installation was so successful that orders soon followed for similar installations in mills, foundries, and later, private houses.

Murdoch kept his employers, Boulton and Watt, fully informed of the progress of his private experiments in this novel field. Their response, however, was to discourage him and urge him to apply his talents to their established business of steam engines. Thus Murdoch's attention, over a period during 1793 and 1794 was diverted from gas-lighting to general engineering. In the year 1800 the firm of Messrs. Boulton, Watt and Company was dissolved and a new partnership set up by the sons of the founders of the firm, who were more receptive to new ideas. With the help of Murdoch and another assistant, the concern soon entered an era of prosperity.

Meanwhile general interest in the potentialities of gas-lighting had increased and in 1802, on the occasion of the Peace of Amiens, a gas light was placed at each end of the Soho factory of Messrs. Boulton and Watt. Within a year the whole works was lighted by gas. With the extension of gas-lighting to cotton mills, the firm established a branch of their business devoted especially to the manufacture of gas-making apparatus.

In 1808 Murdoch addressed the Royal Society on "The Application of Gas from Coal to Economical Purposes" and received the Rumford Medal.

In 1813, one of Murdoch's pupils, Samuel Clegg, entered the service of the London and Westminster Chartered Gas Light and Coke Co., which was granted the right to supply London with gas. Similar companies were soon formed to install gas in most of the large towns. The years immediately following saw Westminster, Glasgow, Liverpool and



WILLIAM MURDOCH—1754-1839

Dublin all lighted by gas.

From all these developments Murdoch—in the classic tradition—derived a minimum of advantage.

But Murdoch's work ranged far wider than that of playing a major rôle in founding the gas industry. His most prolific field of invention was that of mechanical engineering. A full list of his devices and contrivances would occupy many pages, but the selection given below should give some small indication of the breadth and scope of his genius:—

The slide-valve—which superseded the use of a complicated system of levers and taps for the admission of steam to the cylinder of a steam engine;

the oscillating cylinder—which simplified the construction of marine engines;

the rotary engine—the precursor of the modern turbine;

the "Sun and Planet" motion—devised to avoid the use of the crank, which was protected by patent;

the pneumatic pump;

the steam-carriage—the first model locomotive, patented by Watt, but actually invented by Murdoch, originally against the opposition of Watt;

and steam-cases for cylinders cast in one piece instead of in segments.

He was also interested in applied chemistry, and we find a Patent in 1791 for a method of preserving ships' bottoms from fouling by the use of chemical paints. Other chemical discoveries included a cement made from iron borings and sal ammoniac, a substitute for isinglass

from fish-skins and the preparation of aniline dyes from coal-tar.

But the importance of the man rests not simply in what he did directly, but in the developments resulting from his work. Murdoch the man was obviously a most versatile genius whose life was based on a living unity of theory and practice, with the primacy of practice; Murdoch's work, as a factor in the progress of civilization, was an element of the greatest historical significance.

In the same year, 1808, in which Murdoch lectured to the Royal Society, Clegg was in touch with the Society of Arts describing an improved apparatus for the carbonization of coal. Suggestions for using gas for indoor lighting were rejected as "inexpedient" due to the imperfect purification of the gas. This difficulty was soon surmounted and the Society of Arts gradually adopted gas-lighting for its more important rooms. In the following years, gas-lamps progressively replaced oil lamps for street lighting and there were continual improvements in the design of gas-making apparatus. The hydraulic main, the dip seal, the gas governor and the water-meter are some of the more outstanding inventions to the credit of Clegg, who also considerably improved purification plant.

Another important figure who may also claim to be listed among the founders of the gas industry is Winsor, the founder of the Chartered Gas, Light and Coke Company. This most ardent propagandist for the cause of gas-lighting overcame the opposition of Boulton, Watt and Company and, after a struggle, succeeded in having a Bill passed through Parliament permitting the setting up of a company to supply London with gas-lighting.

Murdoch died in 1839.

Let us take a glance at this period in perspective.

The picture that we see is one of a world in rapid development: an age of wheels ; an age of Chartist demands for the People's Charter—for equal electoral districts, universal manhood suffrage and vote by ballot; an age of increased speed, of steam-power being applied more and more widely; of railways being built. 1839 was also the year in which W. H. Perkin was born, who was later to develop the use of coal tar products for the manufacture of dyestuffs. It also marked an extremely important development in the offer of the Gold Medal of the Society of Arts for the prevention of smoke.



Boulton and Watt's Soho Foundry in 1786

But this generally accelerated tempo of advance in the control over the productive forces of nature was resisted by the " gentry " and many of the men of science. All the gas companies had continually to overcome obstacles erected by vested interest and prejudice. And as a broad social trend they succeeded, for this was a period of dynamic economic expansion. A large number of gas companies were formed. Their subsequent development then proceeded along normal lines of competition often followed by amalgamation. The use of gas extended considerably, first into institutions and later into private houses.

Since that time there have been continuous technical developments in plant for carbonization, gas-handling and working up by-products, as well as studies in both the technology and fundamentals of the carbonization process.

Today, interest in the field of carbonization is largely directed towards the problem of utilizing poorly-caking and non-caking coals either in total gasification or coking processes.

For all this later development, the basis was firmly laid by Murdoch. It is due to him in very large measure that the idea and practice of crudely burning raw coal in crude appliances has given way to a more scientific approach based on efficient utilization of this valuable material. If we fail to learn the lesson of Murdoch's work and to appreciate the hidden value of this rich fuel, we shall be squandering a national heritage.

Letters

Heating Our Offices

The Editor,
Smokeless Air.

Sir: The paragraph on " Heating Our Offices " in your Autumn, 1954, issue, calls for criticism. You state, " Central heating of any kind had to be ruled out . . ." No reasons are given, while the last paragraph states, " It will be seen that partly by necessity and partly by intent, the Society is making use of *all* the smokeless mediums it advocates."

From this one must deduce that the Society is against central heating, and yet this method, in the vast majority of cases where it can be applied, is without doubt the most efficient as regards fuel consumption and consequently normally emits less smoke, grit or fumes than any other method.

I hold no brief for this as the sole method, and where appropriate, have used or recommended all the other types you mention. There has, however, been too much advocacy of methods which at the source of use may be efficient, but at the source of generation are grossly inefficient; or alternatively of methods which burn solid fuel slowly but continuously and give just as much smoke or fumes spread over 24 hours a day as the much maligned open fire gives in a much shorter period but in bulk is no worse. These are but examples of method widely coupled with co-called smokeless zones with great complacency.

It is high time the Society and local authorities paid more attention to the real efficiency of methods adopted, and gave less lip service to the smoke abatement cause, and for that reason your misleading report on your activities in dealing with your new offices is greatly to be deprecated. I hope you will correct the impression it conveys.

Yours, &c.,
DONALD V. H. SMITH.

45 *Park Lane,*
*London, W.*1.

(The word " medium " as used in the quoted sentence clearly relates to the energy source and not to the method by which that energy is used. Central heating is a *method* (as Mr. Smith himself calls it) of using one or other of the various mediums—gas, oil, coal, solid smokeless fuel.

Because central heating, generally, can be employed smokelessly the

Society is in favour of it. Even if a central heating plant is not smokeless (as can happen) the Society would criticize the way of using the fuel, but not the way of using the heat. Mr. Smith raises the wider question of whether the Society should concern itself with the way heat is used, provided it is produced without polluting the air.

The reasons for ruling out central heating in our offices were not only because we rent only a part of the premises, but because for the building as a whole any such major improvement was ruled out by the fact that it would be demolished for redevelopment in the not distant future. We have in fact now been dismayed to be informed that the redevelopment plans have been so advanced that we must quit by June next.—ED.)

Toxic Sprays

Sir: I should like to bring to the notice of your Society one aspect of air pollution which is a growing menace in the countryside and far worse than anything that ever came out of a chimney or an exhaust pipe. This is the veritable gas attack given off from agricultural toxic sprays. These sprays, as you will know, are deadly poison, their stench is revolting and their carrying power formidable—anything up to a mile. The particles or chemical given off will penetrate into a house even with closed windows. The effect of breathing the stuff in may be a head cold, running nose, tickling eyes, headache, parched lips, sore throat, tightness of the chest and general *malaise*. Some farmers find they cannot use the stuff as they are too affected themselves, or their families are. To those who live in agricultural communities May and June, once lovely months, have now become the black spots of the year. Old people and invalids, whose only chance of getting air may be to sit in their gardens, now find themselves under constant waves of poison gas.

The present *laissez-faire* attitude of our Ministries towards these deadly poisons has to be read in black and white to be believed. At present, they say " manufacturers of these sprays are not compelled to secure approval for their products before marketing," and if " a person suffers harm there may be a remedy under common law against the user." The " user," note, and " may "! The general public, of course, has an idea that if a thing is used " they " have passed it as safe—it would not be allowed, they think, if it were dangerous or harmful. Yet the above quotation I have given is the ruling of the Ministry of Health! Could your Society tackle this very serious menace of air pollution and add your voice to the Food Education Society and others who are pressing for reforms?

Yours, &c.,
KITTY MEG KITCAT
(*Doctor's wife*).
Mill Cottage, Cockercombe, Somerset.

Compensation for Lung Cancer Death

In Providence, Rhode Island, a case has been heard in the Superior Court in which compensation for the widow was claimed in respect of the death from cancer of the lung of her husband who was employed in the boiler house of the local gas company. It was claimed for the company that cigarette smoking was as likely a cause of fatal lung cancer as the man's work. The judge said that even if cigarette smoking was a contributory cause, " I am satisfied that the occupational exposure, which was many times greater, was a promixate cause." The deceased, Brokop Yarenchoak, had worked for 30 years in the boiler room, and the judge referred to the " burning coke, liquid coal tar, coal dust and soot " in the air he breathed. The decision, which is open to appeal, was to allow the widow workmen's compensation payments of $16 a week for the statutory period of 600 weeks.

In all probability this is the first case of its kind in any part of the world.

The New City of London Act

The "Square Mile" to be Smokeless

Part II of the new City of London (Various Powers) Act, 1954, is concerned with the " prohibition of smoke in the city." Its purpose is to make a smokeless zone of the whole of the city, and both because of the interest and significance of this—the square mile of the city is, after all, one of the world's most important and historic places—and the trends in smokeless zone legislation that the Act shows, an outline of the provisions should be of interest.

From a given date, which may be any date after 2nd October, 1955, no smoke shall be emitted from any premises in the city. The penalty for contravention is not more than £10, with a daily penalty of not more than £5.

Two means of defence are allowed. First, if the smoke arose as a result of using an " authorized fuel," or if a suitable authorized fuel was not available and could not " with reasonable care and foresight " have been made available; and secondly if the furnace or other appliance had been approved as suitable for any fuel (whether an authorized fuel or not) and if such fuel had been used and burnt in accordance with the approval conditions.

The expression " authorized fuel " means coke, anthracite, " or any other fuel from time to time approved by resolution of the common council."

If the occupier of any premises is unable, by reason of some restriction affecting his interest in the premises, to make the alterations needed to comply with the Act, or who considers that the owner should make a contribution, he may apply to the Mayor's and City of London Court for an order to enable the work to be done, or directing the owner to make a reasonable contribution. The common council may, if they think fit, contribute the whole or a part of the expense incurred in making necessary alterations.

The common council may, by resolution, exclude or defer the application of the provisions to any specified premises. Another subsection states that the provisions shall not apply to smoke emitted from a railway locomotive.

A fuller account of the Act, and of the conditions and problems of the City of London, was given by the Medical Officer of Health, Dr. C. F. White, at the Scarborough conference and will be included in the *Proceedings* shortly to be published. Dr. White, among many other points of interest, drew attention to the fact that oil was not included among the authorized fuels. This, he said, was a decision taken despite the plea of petitioners against the Bill. Oil could make a most filthy smoke, and Dr. White did not think the manufacturers of oil-burning plant had yet tackled the problem of absolute smokelessness.

In a memorandum submitted to the Beaver Committee the National Union of Manufacturers suggested that there was no need for additional legislation to reduce atmospheric pollution, but that the problem would be solved if capital expenditure on fuel efficiency were allowed to be charged for tax purposes against revenue in the year in which the expenditure is incurred.

" Season of Mists and Yellow Frightfulness "—neat headline in the West London Press, prompted by the L.C.C.'s recent warning to use smokeless fuels when fogs are forecast.

SMOKE IN THE PUBLIC HEALTH REPORTS

A number of the recently issued Reports of Medical Officers of Health for 1953 contain references and discussion on smoke abatement matters, and following are quotations of particular interest from the Liverpool, Manchester and Sheffield Reports:

Liverpool

The general problem of atmospheric pollution in the City has improved during the year. However, no major improvement can be expected until (*a*) a Smokeless Zone in the centre of the City has been established, and (*b*) compulsory powers of prior approval for all plans of fuel-burning equipment are introduced.

Consideration of a smokeless zone for Liverpool has been receiving attention for some time, and it was proposed that the selected area should be the business and commercial centre of the City where, during the winter months, the air pollution recorded is considerably higher than any other part of Liverpool.

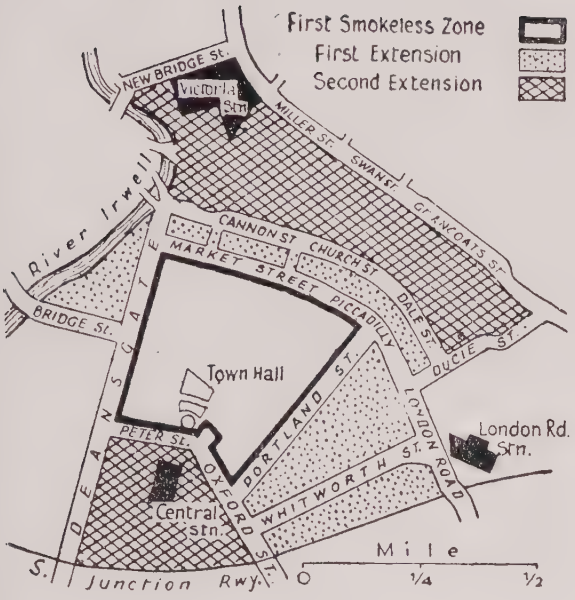
The survey of areas in the centre of the City to be included in an initial Smokeless Zone was completed during the year. Details of the area are given in the text of the report. Before the zone can be introduced, a local Act is at present required. The difficulty of having to introduce local Acts to establish smokeless zones is occurring all over the country, and it might be considered that the time has been reached for this problem to be dealt with nationally.

Manchester

As in previous years, the principal cause of industrial smoke nuisances was found to be due to unskilled firing. Despite the intensive publicity and propaganda on the need for fuel efficiency, and the special course for stokers held at the Manchester College of Technology, only a very small proportion of the men actually engaged in firing furnaces have received any technical training. It would appear that in the present condition of the labour market many of the more skilled men prefer to find less arduous employment in other spheres. It has been observed that, in some instances, employers are reluctant to reprimand careless firemen for fear that they may take offence and seek other employment. In most cases, however, even the most unskilled man is eager to obtain some knowledge of the actual combustion processes taking place in a furnace provided that this can be explained whilst he is at work; some are diffident about attending classes and, where various shifts are concerned, it is practically impossible for a stoker to make regular attendances.

It is remarkable that in those instances where automatic smoke alarms have been installed, no cases of smoke nuisances have been reported. It seems reasonable to surmise that the psychological effect of an audible alarm increases the smoke consciousness of the staff and, if inadvertently dense smoke should be emitted, the firemen are immediately warned of some fault in furnace conditions. As a smoke nuisance is unlikely to be caused deliberately, a fireman can not only take steps to end the dense smoke emission but, also, he is enabled to detect the actual prior causes of the nuisance by the immediate operation of the smoke alarm.

The greater interest in smoke abatement which has been aroused by the success of the central smokeless zone has led to a greatly increased number of complaints from the general public —278 complaints compared with 93 in 1952. Many of these refer merely to smoke emission which cannot be dealt with under the Public Health Act unless a nuisance is being caused. In other cases the nuisances have been



The Manchester Smokeless Zones

The first extension of 130 *acres is to come into operation on* 1*st May*, 1955. *The second extension, of* 178 *acres, has been approved by the City Council and will bring the smokeless area up to a total of* 412 *acres.* (*Map by courtesy of the Manchester Guardian*)

caused by overloaded plant and the only solution would be to reduce production until new plant could be installed. In such circumstances special precautions are advised to minimize any nuisance until new plant can be installed.

In general, the welcome co-operation of the public (in the smokeless zone) has been most marked and occupiers who may have gone to the expense of converting their appliances to smokeless operation have no hesitation in reporting anything they may consider as " smoke " from any premises in the vicinity. Such incidents occupy a large amount of staff time both because of the sporadic nature of such emission and the tracing of its source, particularly when the chimney or stack cannot be seen from the street or any adjoining building. In most instances the " smoke " has been due to the volatile content of the smokeless fuel, or to water vapour produced during combustion or evaporated from the moisture content of solid fuel.

Although there have not been scientific measurements of pollution within the zone, cleaner conditions have been noticeable. Suspended matter is necessarily carried by the wind into the area, but there has been an absence of the heavier matter, such as the larger particles of soot, which normally fall near the source of emission. In some instances there has been greater visibility in the smokeless zone than in the adjoining areas. This may be due to the evolution of warm air and the smokeless products of combustion from the area, which act on the moisture laden air in a similar manner to FIDO on airfields during the war.

The success of the initial smokeless zone experiment has been so marked that, on the instructions of the Health Committee, a further survey of 130 acres was carried out with a view to forming a marginal extension of " the central area " to be bounded by Oxford Street (from Portland Street), the viaduct of the Manchester, South Junction and Altrincham Railway, London Road, Ducie Street, Dale Street, Church Street, Cannon Street, Bank Buildings, Macdonald's Lane, Lower Cannon Sireet, Cannon Street, Cateaton Street, Victoria Bridge, River Irwell, Albert Bridge, Bridge Street West, Bridge Street, Deansgate, St. Mary's Gate, Market Street, Piccadilly, Portland Street.

Sheffield

At the moment it is impossible to promote a scheme for a smokeless zone in Sheffield, for established industrial premises using coal-fired appliances are to be found in the centre of our City. On the other hand, it is not conceivable that this should continue and, sooner or later, and the sooner the better, the industrial premises should be zoned in suitable areas where their sources of power can be obtained from economically managed, centralized sources. There are a number of approaches to the control of smoke; it would probably be better for industry, and it is undoubtedly

right for the community, that industry should be properly zoned, but this is a long-term project. While we take a long-term view of industry, we may be able to take more immediate steps in the new housing estates by requiring the maximum use of fuels that do not produce smoke. There might be difficulties in enforcing this, but sooner or later drastic action, which has already been introduced in other comparable areas, will have to be taken in Sheffield. Areas of this city, which prior to the advent of industry must have been some of the most delightful country in England, are now arid and grim wastes where flowers do not bloom, where vegetation is blasted, and where no one should be expected to live. Unfortunately, the processes continue—slag heaps continue to grow, buildings get dirtier, and the size of desolation increases—the " Industrial Revolution " in its most vulgar form continues to spread itself over the face of the city. There are areas of the city where, because of the polluted atmosphere, it would not be fair or wise to ask young persons to set up house; the coming generation is not given an opportunity to know beauty or to appreciate grandeur as part of its daily life. It can fairly be claimed that the local authority and the people it represents would not now tolerate the pollution of food, and measures to promote health are generally acceptable, but processes that permit the destruction of the beautiful seem to be nobody's responsibility. Once the pleasant things are destroyed they are not easily recreated, for we even get accustomed to drabness, dreariness and ugliness.



From our Photo-Library—21 *Photo: D. G. Shaw*

The Gardens of England

RECORD LOS ANGELES SMOG

Following closely on the heels of the Stanford Research Institute's report of their seven-year investigation into the problem, Los Angeles County was visited for nineteen consecutive days with the smog which is rapidly becoming as famous as the Californian sunshine. Occurring, as it did, during the preparations for the elections for both the State Governorship and the Senate, the smog gave rise to considerable outspoken controversy and became one of the main, and, indeed, for a time, the only, election issue.

During the first two weeks there were several meetings of irate citizens to discuss the problem, and the local newspapers bear witness to the growing unpleasantness of the situation. One Los Angeles Councilman is reported as saying that the people were so annoyed that he was afraid they would shoot someone. There had already, he said, been threats to tar and feather the officials responsible for the menace to the public health. Drug stores reported a run on eye-wash, and one, opposite a hospital, said that the unprecedented demand had caused it to run out completely. A grim note is struck by the report that at one time the concentration of pollutants was so close to danger point that the Mayor of Los Angeles, Norris Paulson, and Gordon P. Larson, anti-pollution district director, were on the point of issuing an emergency proclamation to stop much of the smog-producing activities in the area. Fortunately the next day saw a slight lessening of the concentration.

The largest meeting, of about 6,000 residents from the county's 48 cities, was held in Pasadena during the third week of the smog. Resolutions were passed asking the Los Angeles Grand Jury to investigate " at once " any possible breakdown in the smog law enforcement. The Citizens' Anti-Smog Action Committee, which sponsored the meeting, hinted that smog officials may " have been guilty of dereliction of duty." A typical poster at this meeting read, in very large letters, "Action or Else! "

On a visit to Los Angeles the U.S. Defence Secretary, Charles E. Wilson, promised to use his influence to hasten perfection of a filter for motor exhaust fumes, one of the chief culprits. At the same time the Governor, Goodwin J. Knight, who had already obtained a grant of $100,000 for a further study of the problem, called on the twenty-five oil companies operating refineries in the area to shut down in order to determine the extent of their responsibility for the smog. The companies, however, were practically unanimous in their refusal to consider the proposal, only the Shell company offering to meet the Governor for discussion. The various others are reported as saying that the proposal was prompted by political considerations and was, in the words of one spokesman, " completely impractical from the industry standpoint."

Eventually, after nineteen days, the temperature inversion which was holding the pollutants in the area lifted. According to the Stanford Research Institute report mentioned above, these inversions, together with the ring of mountains round the area and the bright sunshine, are mainly responsible for the formation of the smog. The stagnant condition of the air allows time for the sun to act on a mixture of ordinary harmless chemicals and form a combination which reduces visibility, causes irritation of the eyes and throat and severely damages crops. Another contributing factor is ozone, of which the Los Angeles atmosphere has the highest concentration known on the earth's surface.

The problem is a difficult one which has resisted all efforts at elimination made in the past few years. The Institute's conclusion is that much has been done, but that much more remains to be done.



Smoke Clouds over Lancashire—*A view, taken looking from Oldham, (above) early in the morning and (below) a few hours later on the same day*

(Photos: By courtesy of Midweek Oldham Mirror)

THE MINISTRY OF HEALTH REPORT ON LONDON SMOG

By a Medical Correspondent

Early in 1953 the Minister of Health set up a committee of departmental officers and expert advisers to marshal and examine the facts on the London fog of the previous December. The report of this committee has now appeared. **(Reports on Public Health and Medical Subjects No. 95.** H.M.S.O. 2s. 6d. net.). All available information on the public health aspects of the fog has been collected and subjected to critical examination. Much of it has already appeared elsewhere, but a considerable amount of new material is presented. No startling new conclusions emerge, but the committee have succeeded in bringing together a great deal of factual information in small compass, and the tables, published as appendices, will be invaluable for reference. (A report by a veterinary officer on the effect of the fog on cattle at the Smithfield Show also appears as an appendix. A considerable number of cattle developed respiratory disease, but sheep and pigs were unaffected).

The report begins with a summary of the meteorological conditions during the fog and the degree of atmospheric pollution in the different parts of the Greater London area, these being matters that have been considered in detail elsewhere[1&2]; but, as would be expected, the main body of the report is concerned with the effect of the fog on sickness and mortality.

At first sight it seems a simple matter to discover from the death returns how many people died from the fog. But the fatal diseases during a fog are diseases from which people also die at other times, and it is not easy to decide what the level of mortality would have been if there had been no fog. The committee come to the conclusion that the number of excess deaths due to the fog in the Greater London area was between 3,500 and 4,000, and probably nearer to 4,000.

The report discusses possible delayed effects of the fog, and the suggestion that a considerable amount of the mortality in January and February may have been due to the December fog. It is pointed out, however, that following the fog mortality had returned to normal levels before the January rise occurred, that the rise in mortality in January and February was not confined to the Greater London area but took place also in the other great towns, and that from the last week in December onwards an outbreak of virus A influenza was known to be in progress. The committee conclude that although there may have been some delayed deaths from the fog the greater mortality in January and February was due to the influenza epidemic.

In the Greater London area the biggest increases in deaths during the fog week were in the county of London and in the part of Essex lying in the Greater London area, the least being in the part of Kent in Greater London. The increase in the number of deaths was greatest in those over 45 and in those under one year of age, but the numbers were vastly different at each extreme of age, the excess being 26 in the under-one age group and 1,472 in the group aged more than 45. During the week of highest mortality 81 per cent. of the deaths were due to diseases of the respiratory and cardiovascular systems, 59 per cent. were due to respiratory disease only, bronchitis, particularly chronic bronchitis, being the main cause.

The report contains a detailed analysis of the deaths reported to

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1. Douglas C. K. M. & Stewart K. H. 1953 Meteorological Magazine **82**: 67.
2. Wilkins E. T. 1954 J. Roy. San.Inst. **74**:1.

coroners during the fog. Many of these had died suddenly or unexpectedly. Sudden deaths from respiratory disease rose during the fog to four times their normal level, and continued at a high level for some time, whereas a rise in the number of sudden deaths from cardiovascular disease was limited to the foggy period. Bronchitis and emphysema showed the greatest proportionate increase in the coroners' series; coronary disease rose only in proportion to the total number of deaths, and pneumonia did not increase in proportion to the deaths. It is suggested that a combination of respiratory and cardiovascular disease, although not forming a greater predisposing factor than respiratory disease alone, may have increased the likelihood of death occurring suddenly during the fog.

From the reports of coroners' pathologists it was seen that the pathological findings in those who died during the fog were essentially similar to those found after death from the same causes at other times. A chemical analysis of four lungs from persons dying in the fog, carried out by the Government Chemist, failed to show any significant difference between the mineral content of the lungs and that of a control lung.

Information provided by Medical Officers of Health confirmed the absence, at the time of the fog, of any prevalence of infectious disease of the respiratory system which might have accounted for the sudden rise in deaths. Usually illness was confined to one member of a household. Most of the fatalities occurred in persons who had been suffering from chronic respiratory disease. The distribution of deaths by social class was no different from normal times.

Death registration is universal and mortality figures are therefore complete. By contrast there is no comprehensive system of registration of sickness in the community, and considerable discussion has taken place on the amount of non-fatal illness attributable to the fog. The committee wisely discarded the suggestion of a retrospective survey of sickness in a sample of the population on the grounds that the information obtained at interviews would have been coloured by publicity subsequent to the fog. They have, however, performed a service by setting out the data available from four sources, viz., sickness claims of the Ministry of Pensions and National Insurance, hospital admissions, notifications of pneumonia, and information from selected general medical practitioners.

During the weeks before the fog the rate of sickness benefit claims in London and Middlesex followed closely that in the rest of the country, but in the week after the fog the rate in London and Middlesex became proportionately much higher. It is estimated that there was in London and Middlesex an excess of 9,000 claims over the expected number during that week. The increase in sickness was proportionately much lower than the increase in mortality, partly because the sickness benefit claims refer only to the population of working ages, and partly, no doubt, because the fog did not in fact cause in healthy persons as much illness as might be expected from the mortality rate. It was also noted that the rise in sickness rate appeared in the figures a few days later than the rise in the mortality rate. A great increase in the number of hospital admissions for respiratory and cardiac diseases occurred during the fog. The work of general practitioners was increased at this time, mainly by an increase in respiratory disorders. One practitioner noted that several patients with chronic bronchitis and heart disease who remained in bed during the fog appeared to be unaffected.

Details are given of previous severe fogs in this country and the 1952 fog is shown to have been more lethal than any other. A description is also provided of the Meuse valley and Donora episodes. It is noted that whereas in the London fog the death rate increased steeply from the first day of the fog to a maximum on the fourth day, in the Meuse valley and Donora

fogs the first deaths did not occur until the third and fourth days respectively. It is thought that this was probably due to the larger number of susceptible individuals in London rather than to greater toxicity of the London fog.

The committee were unable to identify any one constituent of the fog as being responsible for the increased mortality, but concluded that the fog mortality was due to irritation of the respiratory tract of persons already suffering from respiratory or cardiovascular disease by contaminants in the fog which were probably derived from the combustion of coal and its products.

The report is written in the language of restraint; nevertheless, the story that emerges is obviously that of a catastrophe of the first magnitude. It was not within the scope of the report to consider measures for the prevention of atmospheric pollution, but it has been clearly shown that the lethal effects of the fog were largely confined to a susceptible group of persons who can be identified. The lesson to health workers is that this group should be given the benefit of advice on such protective measures as can be devised.

A.M.C. MEMORANDUM TO THE BEAVER COMMITTEE

The Association of Municipal Corporations has published (Supplement to *Municipal Review*, October, 1954) the text of a memorandum submitted to the Beaver Committee on Air Pollution. The greater part of the memorandum was concerned with the law and its administration, and the Association said bluntly of the provisions of the Public Health Act, 1936, that " their construction gives rise to such diversities of opinion amongst lawyers and laymen alike that the Association are of the opinion that, in their present state, these provisions are virtually unworkable."

Many pertinent criticisms of detail were made, and also practical suggestions for improvement. The definition of " chimney " was stated to require amendment, and its present inadequacy indicated by reference to nuisances from coke ovens and carbonizing plant. It was suggested that " premises " should be used instead of " chimneys." It was urged that the qualified exemption to certain processes (section 109) " should be withdrawn forthwith," and that the control of smoke from shipping, which was regarded as a grave problem, should be altered. " There appears to be little justification for the lavish exemptions accorded to shipping by the law in its present state."

Colliery spoilbanks, railway smoke and road vehicles were also discussed. On the Alkali, &c., Works Regulation Act the Association stated that they " do not favour the extension of any system of control by a Government inspector," and more generally:

" Local authorities are best fitted to deal with problems of primarily local incidence including, of course, air pollution, and the Association see no need for any system of Government inspection. It is thought that some of the smaller local authorities might favour the establishment of regional advisory bodies consisting of representatives of local authorities to advise on questions relating to air pollution and smoke abatement. The advisory bodies should be staffed by appropriately qualified officers and the alkali inspectors might well form a part of such staff."

The Association records that they favour the constitution of smokeless zones and that legislation should be introduced conferring the necessary general powers on local authorities. Approval is also given to the Bradford and Nottingham procedure of making the use of smokeless fuels a condition of tenancy.

WEST RIDING DOMESTIC SMOKE CAMPAIGN

An interesting " smoke campaign " was organized in the West Riding recently by the Solid Smokeless Fuels Federation. A series of meetings and exhibitions were held between 13th September and 16th October, under the auspices of the West Riding of Yorkshire Regional Smoke Abatement Committee, and the Yorkshire Division of the National Smoke Abatement Society.

The scheme was conceived last February, when the Federation was asked by the Borough of Wakefield for advice on the availability and utilization of solid smokeless fuels. The Federation arranged a meeting to which representatives from other local Councils and interested organizations were also invited, and a suggestion to run a domestic smoke campaign was enthusiastically adopted.

Twelve local authorities were selected, well distributed over the area, and several informal meetings were held before the campaign began. Considerable use was made of special invitation cards, but Press and poster advertizing was limited by financial considerations. Even so, the local and national Press showed interest beyond expectation, and well supported the campaign.

At the inaugural meeting a message was read from Sir Hugh Beaver, Chairman of the Air Pollution Committee, emphasizing the need for " the constant, continued, emphatic pressure of public opinion," and wishing the campaign " great success."

The campaign consisted of meetings in the towns visited, supplemented by the use of the Mobile Exhibition Unit (which made a special journey to Scarborough at the time of the Society's conference and was inspected by those attending). The meetings provoked a good deal of discussion. They were usually opened by the Mayor or Chairman of the local authority, and the film " Guilty Chimneys " was shown. The causes and effects of air pollution were then presented by the Medical Officer of Health, or the Sanitary Inspector, or by both in co-operation. Discussion at the meetings seemed to focus mainly on the questions of availability, quality and price of smokeless fuels. There was much discussion on the point that the burning of smokeless fuels, because they are more efficient, would result in net saving.

The impact of a campaign of this kind cannot be assessed in material terms, but it does help to mobilize the "emphatic pressure of public opinion," mentioned by Sir Hugh Beaver.

The Black Sheep of Manchester

Mr. R. C. McMillan, director of Parks to the City of Manchester, spoke of the effects of air pollution in that city at the recent Public Works Congress. Country turf, he said, brought into the city looked splendid the first summer, but in the following January it started to die out. Ferns which would not survive in a sunny position in the open country did well in a south aspect on the north side of Manchester.

Visitors had commented on the flock of black sheep kept by a farmer in Manchester's largest park, little suspecting that on their arrival three months earlier they had been snow-white. Mr. McMillan felt it was a great pity that because of the dirt none of the grass in the city's parks could be allowed to grow long for children to play in, but he saw a ray of hope in the introduction of the smokeless zone. Last summer, he said, *Salvia Harbinger* a sun-loving plant, had bloomed quite cheerfully in this zone. To his knowledge that had never happened before.

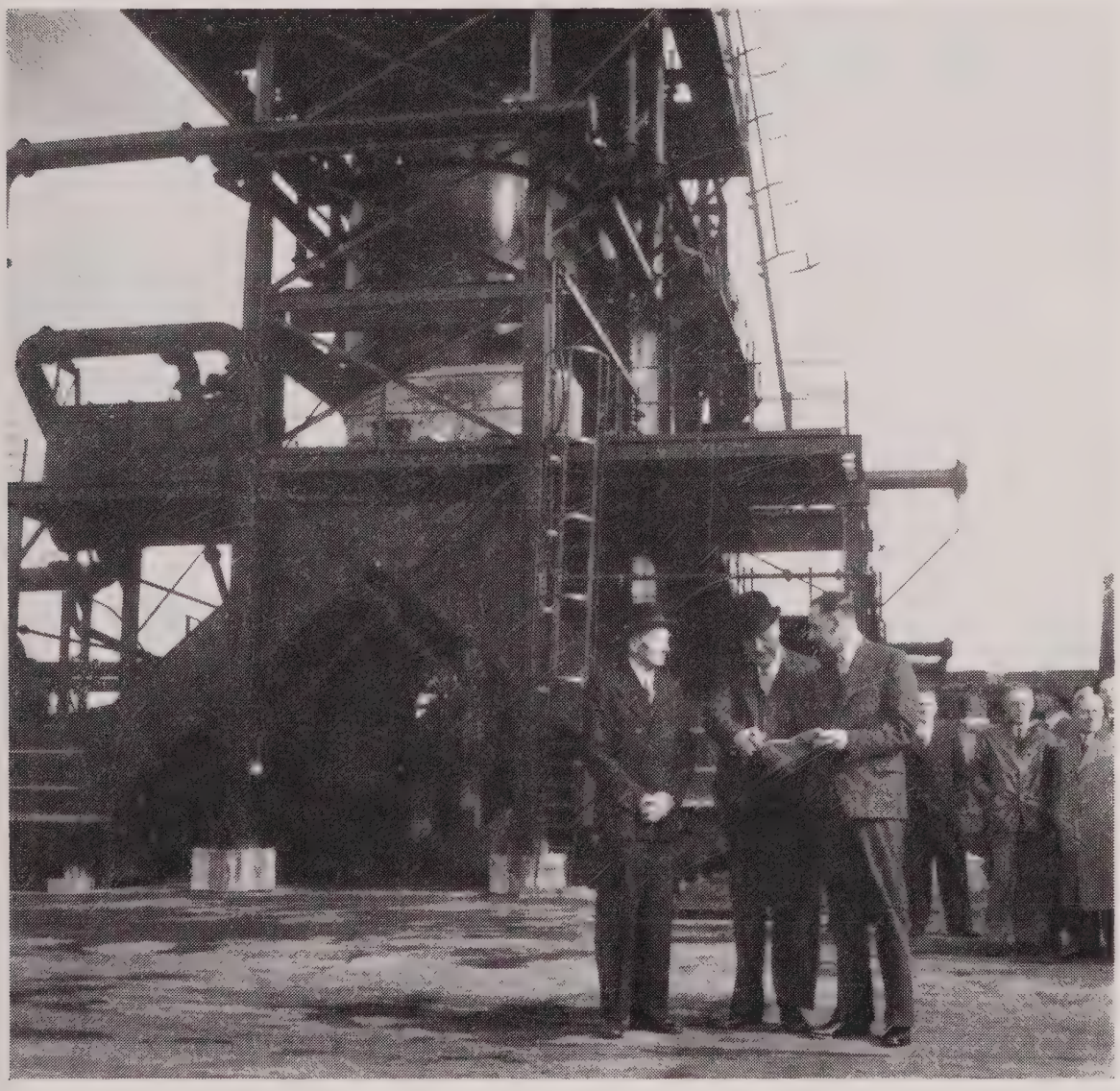
Rexco Plant Extension

Among the solid smokeless fuels " Rexco " is deservedly popular, and the only complaint about it is that there is not enough. It is a free-burning fuel of high quality, suitable for both open fires and closed appliances. The process by which it is made was described in a special article in *Smokeless Air*, Summer, 1951 (No. 78).

Production will now be increased, for on 6th October a new retort was formally inaugurated by Lord Brabazon of Tara in the presence of a number of guests representing the Ministry of Fuel and Power, the National Coal Board, and other organizations concerned with fuel and its utilization, including the National Smoke Abatement Society.

The original retorts, which are adjacent to the Mansfield Colliery of the National Coal Board, had a capacity of 34 tons of coal. The new retort, which incorporates an improved method for the combustion of gas before circulation through the retort, has reduced the carbonizing time to give a daily throughput of 58 tons of coal per retort.

The new retort, made by Newton



THE NEW REXCO RETORT

In front, left to right, are Colonel Vaughan Cowell, Lord Brabazon of Tara, and Mr. Anderson Brown

Chambers & Co. Ltd., has the same internal dimensions as the originals—34 feet high and 11 feet diameter—but contains modifications resulting from experience gained in the past.

At the official ceremony Lord Brabazon pressed a button which set in motion the ram which withdraws the grate under the retort. The fuel was discharged on to a ramp and led by belt conveyors to the screening plant.

At a luncheon which followed the ceremony, and a tour of the plant, Lord Brabazon paid a warm personal tribute to the Managing Director of the parent company, the National Carbonizing Company Ltd., Colonel A. Vaughan-Cowell. In the course of a witty speech he spoke of his delight in the open fire, although, he said, he knew he should not do that. He had been told it was a wonderful method of wasting heat, and that our coal would run out in about 200 years. "These things do not interest me," he said. "I have taken part in two wars and am taxed nearly 100 per cent. for posterity—but if posterity cannot look after itself, and keep itself warm in two hundred years' time, then it can freeze!"

Lord Brabazon asked the visitors to note how small were the capital costs, and that the plant was easy to erect and had no moving parts. Most important, he considered, was the fact that the process was paying.

Colonel Vaughan-Cowell, in thanking Lord Brabazon, said that he could not possibly have succeeded in bringing the "Rexco" process to its present successful stage without the theoretical knowledge, practical experience, resource and ability of Mr. Anderson Brown, the Managing Director of the operating subsidiary company, Midland Rexco Ltd.

Lord Citrine, chairman of the British Electricity Authority, opened a new power station costing £18,000,000 at Brunswick Wharf, East India Dock, London, in September. Speaking of atmospheric pollution, he said that the new station had not been fitted with flue-gas washing equipment, as had the stations at Battersea and Bankside, because B.E.A. engineers were firmly convinced that it was ineffective, apart from the high cost, which ran into millions of pounds. It increased rather than diminished atmospheric pollution near a power station.

The Brunswick station, he said, was fitted with the most modern boiler plant to ensure efficient combustion and to prevent the unnecessary emission of smoke or dust. The electrostatic precipitators had an efficiency of up to 98 per cent. and the buildings had been designed in such a way that the gases were emitted from the chimneys at a high temperature which carried them into the upper air stream and so dispersed them over a wide area.

Operators of large fleets of diesel-powered vehicles in the Birmingham area have received an appeal made jointly by the Chief Constable of Birmingham, Mr. E. J. Dodd, and the Medical Officer of Health, Dr. Matthew Burn, asking them to co-operate in the reduction of smoke emission from diesel vehicles by concentrating on preventive maintenance. The letter, pointing out that during the past 40 years motor vehicles have contributed on a steadily increasing scale to atmospheric pollution, especially in busy central areas, reminds operators of the duty of the police to enforce the law in relation to offences committed in this connexion, and concludes: "It is in our view, however, more by co-operation than prosecution that the evil of this problem can be avoided and we invite all users of diesel-powered engines to consider what futher preventive measures can be taken in respect of their vehicles." A similar letter was sent to the local Press in the hope that owners of small fleets would take similar steps.

DOMESTIC SMOKE REDUCTION

From a talk by Dr. W. Davidson, of Radiation Ltd., to the East Midlands Division of the Society at the works of Park Foundry (Belper) Ltd., on 8th July, 1954, with Alderman S. Cooper (Leicester) in the Chair.

To make progress in domestic smoke abatement we must have a full appreciation of the sources of domestic smoke and of the factors which can contribute to a reduction of this smoke.

Let us consider first the source of domestic smoke. Immediately pre-war the annual consumption of coal in domestic appliances had risen to some 50 million tons. This consumption has now dropped to 32 million tons due to rationing, increased costs and some increase of efficiency of utilization.

How is this coal used? Solid fuel satisfies approximately 98 per cent of the total domestic space heating load in the following way: Two-thirds is burned in open fires, one-quarter in ranges, and about one-tenth in combination grates, open stoves, etc. The space heating from these appliances is often combined with water heating and sometimes with cooking also.

The greatest contribution to domestic smoke abatement can therefore be made by attention to space heating methods.

Solid smokeless fuels can play an important but unfortunately only a small part, owing to limitations of supply, and we must continue to regard coal as the basic domestic space heating fuel for many years to come. Methods must, however, be found of burning this fuel more efficiently, effectively and with reduced smoke.

Before discussing appliances, I would like to refer to one factor which plays a very important part in the efficiency of fuel utilization and therefore in smoke abatement—the insulation of the house. By insulating the house to the Egerton Standard, and this is now being done by some local authorities and by many private builders, at little or no additional cost, a saving of 25 per cent. can be effected in the fuel required for space heating. Where coal is used and the same comfort standard accepted this represents a 25 per cent. reduction in smoke emission.

Consider now the contribution towards smoke abatement which can be made by the appliance as a result of increases in heating efficiency and reductions in smoke emission due to improved combustion of the coal.

Appliance	*Efficiency using coal Percentage*	*Coal burning rate in lbs./hr.*	*Smoke emission for equivalent heating of a room 1750 cu. ft.*	
			Weight of smoke in lb./hr.	*As percentage reduction over pre-war coal fire*
1. Average pre-war coal fire ..	23	3.5	0.105	0
2. Improved open fire ..	28	3.2	0.100	5
3. Convector (non-boiler) (Convection to same room)	35	2.5	0.09	14
4. Openable stove	38	2.4	0.089	15
5. Parkray No. 1	33	2.3	0.087	17
6. Parkray No. 2 with boiler ..	50 (including water heating)	2.7	0.020	80

The table on page 107 sets out these efficiencies and gives estimates of the reductions in smoke emission from the various appliances when providing about the same comfort conditions in a room.

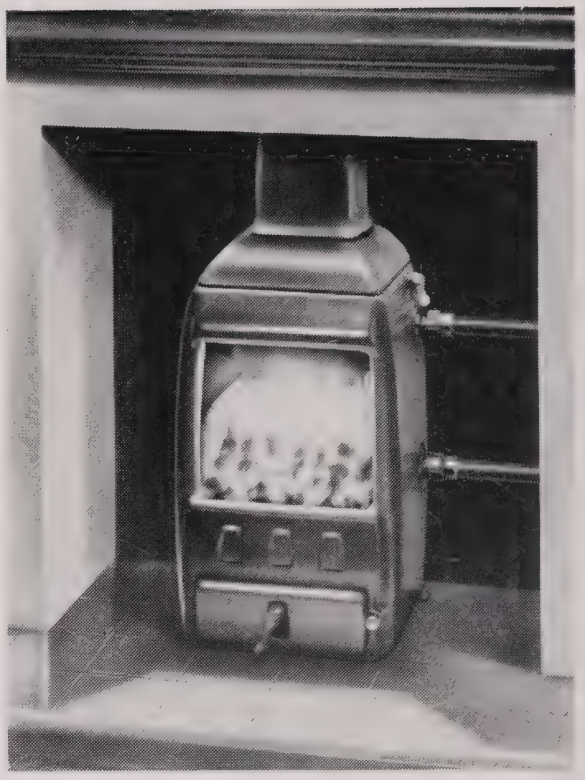
The smoke emission for equivalent room heating takes into account the actual room heating efficiency allowing for the reduced ventilation obtained where the flue throat is restricted as in items 3, 4 and 5 shown in table.

The reduction of the smoke emission given for the Parkray No. 2 is a conservative estimate and it is important to note that this substantial reduction can be obtained even when burning nutty slack. Another noticeable feature is that the same standard of room heating comfort is obtained plus hot water from the Parkray type of fire by burning less than three-quarters of the coal used on a pre-war fire.

The Parkray (see illustration) is a free-standing open fire with down-draught firebox. A large proportion of the volatiles which are drawn down through the hot fuel bed are burned by mixing with preheated secondary air. This accounts for the reduced smoke emission and the high efficiency obtained.

Being a free-standing unit, the full advantage of convection heating is obtained and, combined with the radiation of the open fire, gives uniform heating over the whole area of the room. The restricted flue throat reduces the quantity of air drawn up the chimney, so increasing the effectiveness of the unit and substantially reducing draughts. A plentiful supply of hot water is provided from the back boiler. Gas ignition is provided for lighting the fire.

The solid fuel Radiation Whole House Warming Unit has a closed down-draught firebox and burns coal virtually smokelessly and at the high average efficiency of 75 per cent. This unit, when connected to a system of ducting, is used for the circulation of warm air to the various rooms as desired, the temperature being thermostatically controlled at the desired level. Domestic hot water is also provided from a 40-gallon cylinder in the heater cabinet.



The Parkray No. 2

In the discussion which followed, Mr. W. A. Ballard, Director and General Manager of Park Foundry, told the meeting that a similar fire to the Parkray No. 2, but without boiler, to be known as the Parkray No. 3, was under test by B.C.U.R.A. for a report to the Beaver Committee on its smoke reducing capabilities. This fire had been designed to fit into existing fireplaces for room heating.

He went on to say that at present the regulations imposed in smokeless zones demand complete smokelessness. Although a large measure of smoke reduction can be obtained from the Parkray type of fire burning bituminous coal, it is unlikely that complete smokelessness can be attained with an open fire burning coal. Until increased supplies of good quality coke and other smokeless fuels are available for domestic use—at present they represent only about 10 per cent. of solid fuels used for

[*concluded, page* 110]

SMOKE PREVENTION ABSTRACTS

216. Some Measurements on the Smoke from Open Fires. L. L. Fox. (J.Inst. Fuel **27,** 385-389. August, 1954). Measurements have been made, for one particular coal, of the smoke in the flue gases from a stool-bottom grate and from a smokeless-fuel grate, each installed with its own fireback. Within the range of the experiments, it was found that with both grates the amount of smoke, expressed as a percentage of the corresponding refuelling charge, was independent of the weight of that charge and of the average burning rate of the fire.

217. Atmospheric Pollution from Hydrocarbons in Automobile Exhaust Gases. F. H. Viets, G. I. Fischer and A. P. Fudurich. (Paper to Amer. Industr. Hyg. Ass., Los Angeles. 23 April, 1953. Publ. 43, 4pp.). Observations were made under road test conditions on a 1947 Chevrolet. Over the test route 18 per cent. of the time taken was occupied by idling, 18 per cent. by acceleration, 46 per cent. by cruising and 18 per cent. by deceleration. Gasoline consumption for each period was determined. The exhaust gas flow rate was measured by an orifice meter. Hydrocarbon concentrations were determined by infra-red spectrophotometer from instantaneous samples obtained by special apparatus and techniques which are described. From these data total emissions were calculated. Weighted for the volume of exhaust gases, hydrocarbons (reported as hexane) are released to the atmosphere as follows: idling 2.33 g/min; acceleration 1.07 g/min; cruising 0.72 g/min, and deceleration 8.97 g/min. Adding the other hydrocarbon fractions not included in these figures, gives a value of 620 tons released from the 100,000 bbl. of gasoline consumed in Los Angeles each day. As a solution to the problem after burners or exhaust attachments are being developed and tested. (D.S.I.R.).

218. Occupation as a Factor in the Community Health Hazards of Air Pollution. C. A. Mills. (Amer. J. Med. Sci., Aug., 1953, vol. 226, 177, 178; abstr. in Industr. Hyg. Dig., Jan., 1954, vol. 18, 39). The death rates for pneumonia and for cancer of the respiratory tract in the cleanest and dirtiest areas of Chicago are classified according to occupation. The death rates for both diseases in the most polluted areas are found to be 2.5 and 3.5 times as high among labourers with outdoor exposure as among professional workers. The author believes that the higher rate for pneumonia might be attributed to poor housing and low economic status but that those factors would not account for the high cancer rate. He concludes that urban air pollution is a significant factor in the incidence of cancer. (D.S.I.R.).

219. Air Pollution and Bronchitis. J. Pemberton and C. Goldberg. (Brit. Med. J., Sept. 4, 1954, 567). A significant correlation has been found between the average sulphur dioxide air pollution in the county boroughs of England and Wales and the mortality rates for bronchitis in men aged 45 and over, for the three years 1950, 1951 and 1952. In only two of six sets of data was a similar correlation found for women of the same ages. The association between air pollution with solid matter and bronchitis mortality was much less consistent. Only three of the six sets of data in the case of men and two in the case of women were significant.

There was no significant association between average sulphur dioxide pollution and two indices of general social conditions. The latter consisted of one based on income and one on housing conditions. The evidence supports the hypothesis that sulphur dioxide air pollution is a factor in determining the magnitude of the bronchitis death rate of middle-aged and elderly males. (*See also* 220).

220. Air Pollution and Bronchitis. C. Daly. (Brit. Med. J., Sept. 18, 1954, p. 687, in a communication referring to the paper abstracted above). For the years 1946-50, an analysis, similar to that by Pemberton and Goldberg (119, above), was made by the Social Medicine Research Unit of the Medical Research Council. Since pollution records were unsatisfactory, another index of pollution was sought. Correlation coefficients were therefore calculated between the amount of coal burnt per acre of the English and Welsh county boroughs, and deaths from bronchitis and pneumonia averaged over three years. Between the average annual mortality for males of 45-64 years, so calculated, and the consumption of domestic coal per acre in 1952, the

coefficient was 0.59. Correction for poverty reduced this to 0.52, and correction for overcrowding reduced it to 0.53.

Between the consumption of *all* coal, including non-domestic coal which produces much less smoke, and the above mortality rates there is a correlation of only 0.24, suggesting that it would be premature to attribute the apparently bad effects of air pollution to sulphur dioxide alone.

THE EFFECTS OF A SMOKELESS ZONE

In a paper to the Public Works Congress in London recently, Mr. W. B. Kennedy, Senior Smoke Officer, Manchester, spoke highly of the consequences of a smokeless zone. Rising standards of living were creating a demand for a cleaner atmosphere, but one individual could do little about it.

"How different," he continued, "is the situation when compulsion on a section of the whole community is enforced! Intense interest in the communal effort is aroused. Everybody is involved, and clean air is the cause of initial inconveniences and the subject of conversation. Civic consciousness is awakened and backsliders suffer from a sense of guilt, while the law abiders feel self-righteous. A higher standard of clean air being achieved, the residents are more sensitive to pollution from outside sources and demand an extension of the compulsory smokeless area and drastic reduction of industrial smoke. Such are the advantages of smokeless zones."

FILM STRIPS

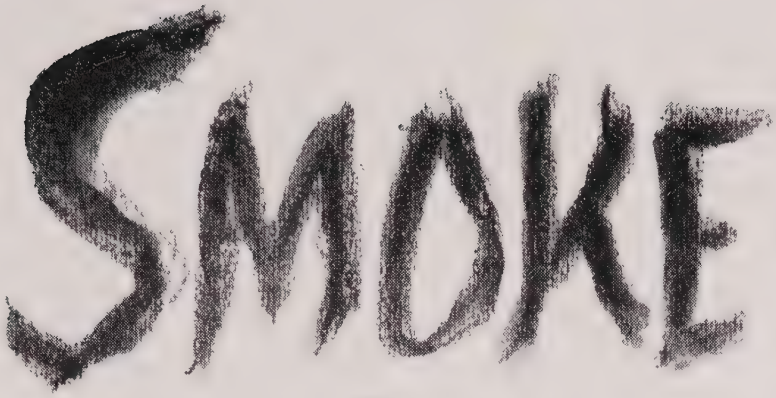
Film strips are becoming more popular and two on air pollution have recently been produced. One has been made by the Central Council for Health Education and was shown at the Scarborough conference. It aims at being no more than a short ($4\frac{1}{2}$ minutes) introduction to a discussion on the subject, and takes the form of a series of photographs, with recorder commentary, which tell a simple human story—that of the parents of a small boy in a smoky town who are advised that the boy's bronchial condition will improve only if they move to a clean district. But the father is tied to his job—which happens to be that of a stoker in one of the factories! What should they do? There the strip ends, and it is then for the lecturer to start the discussion and develop it on the right lines. This unusual technique does work with many subjects; whether it is the best way of beginning a discussion on air pollution must depend, it would seem, on the lecturer and on the type of audience.

The other strip has been produced by Camera Talks (23 Denmark Place, London, W.C.2), with the advice of the Sanitary Inspectors' Association. It consists of a strip of about 30 frames, photographs and diagrams, illustrating the various aspects of the problem and appliances and instruments, and provides a well-balanced presentation. The strip, which is supplied with a booklet of notes, is sold at two guineas a copy. It is not available for hire.

It may be added that the Society has been seeking to produce its own film strips, for the use of members, but the demands of other activities have so far prevented progress being made.

Domestic Smoke Reduction—*continued*

domestic purposes—it seemed that the regulations for the extension of smokeless zones would have to be modified to enable smoke reducing open fires to be installed for burning bituminous coal until more smokeless fuels are available. In this way we should be able to obtain a large measure of smoke reduction in industrial areas more quickly than by waiting for increased supplies of smokeless fuels, and with the Parkray type of fire which will burn smokeless fuels with equal high efficiency, the changeover to complete smokelessness with the aid of smokeless fuels can be effected without the cost of altering or replacing the appliance.



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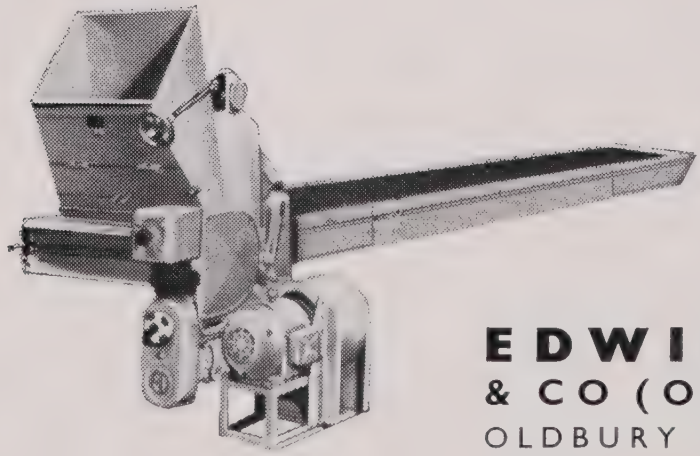
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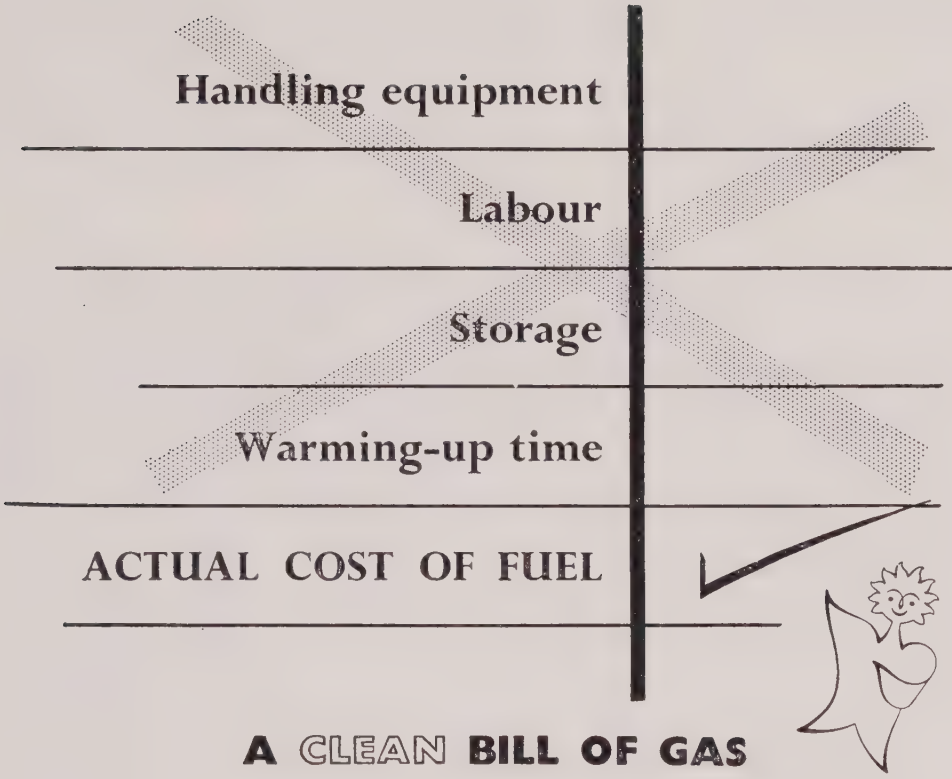
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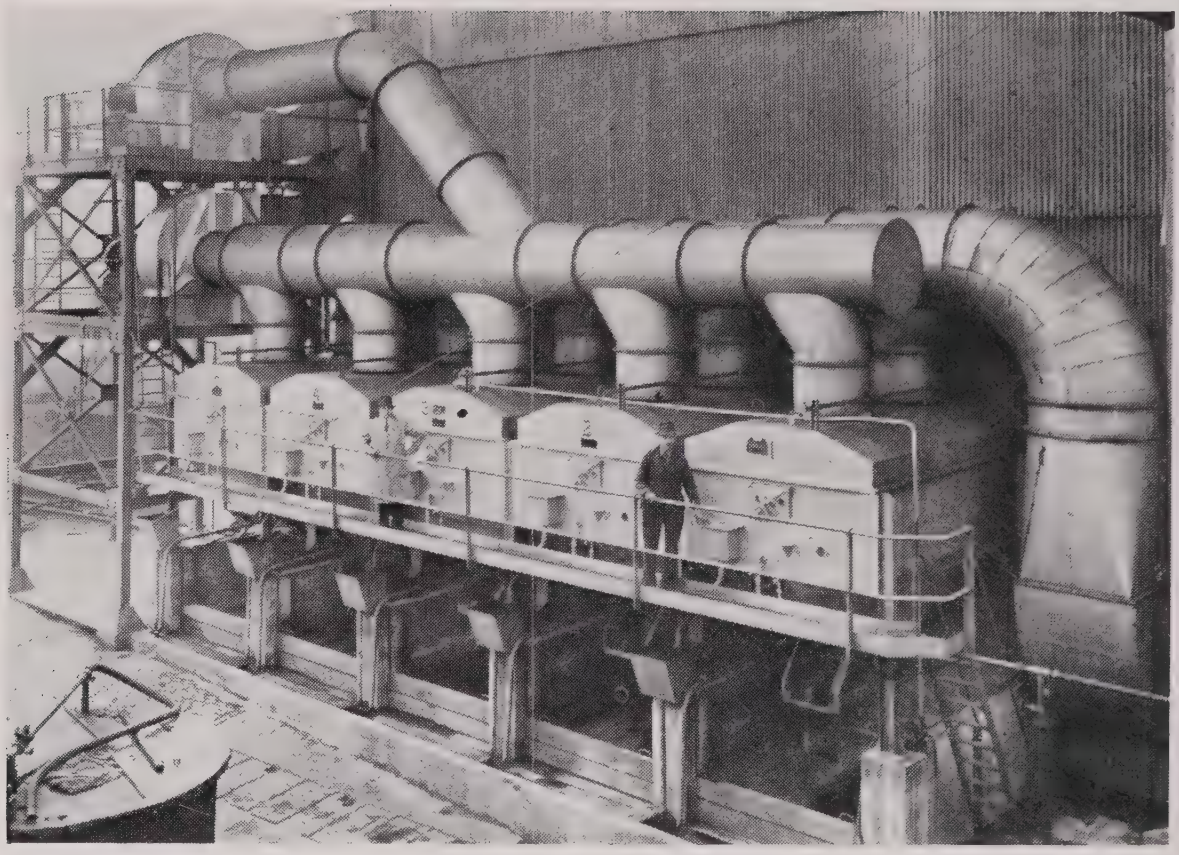
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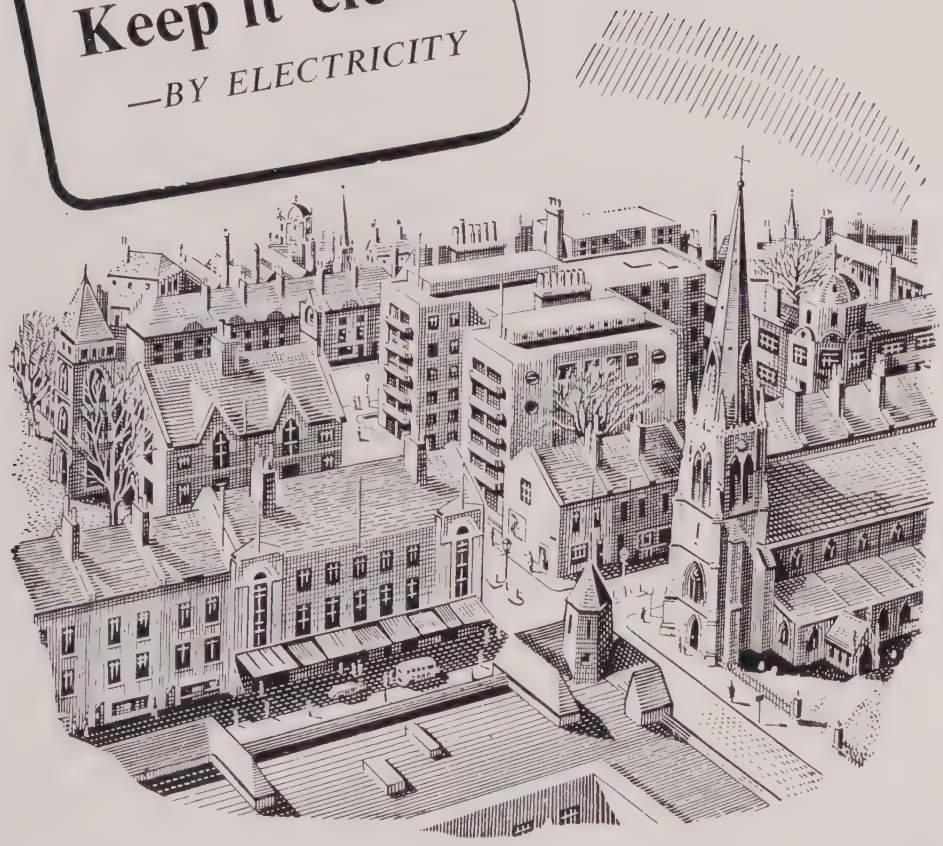
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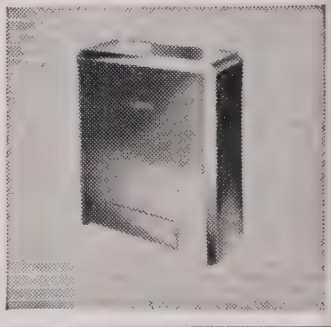


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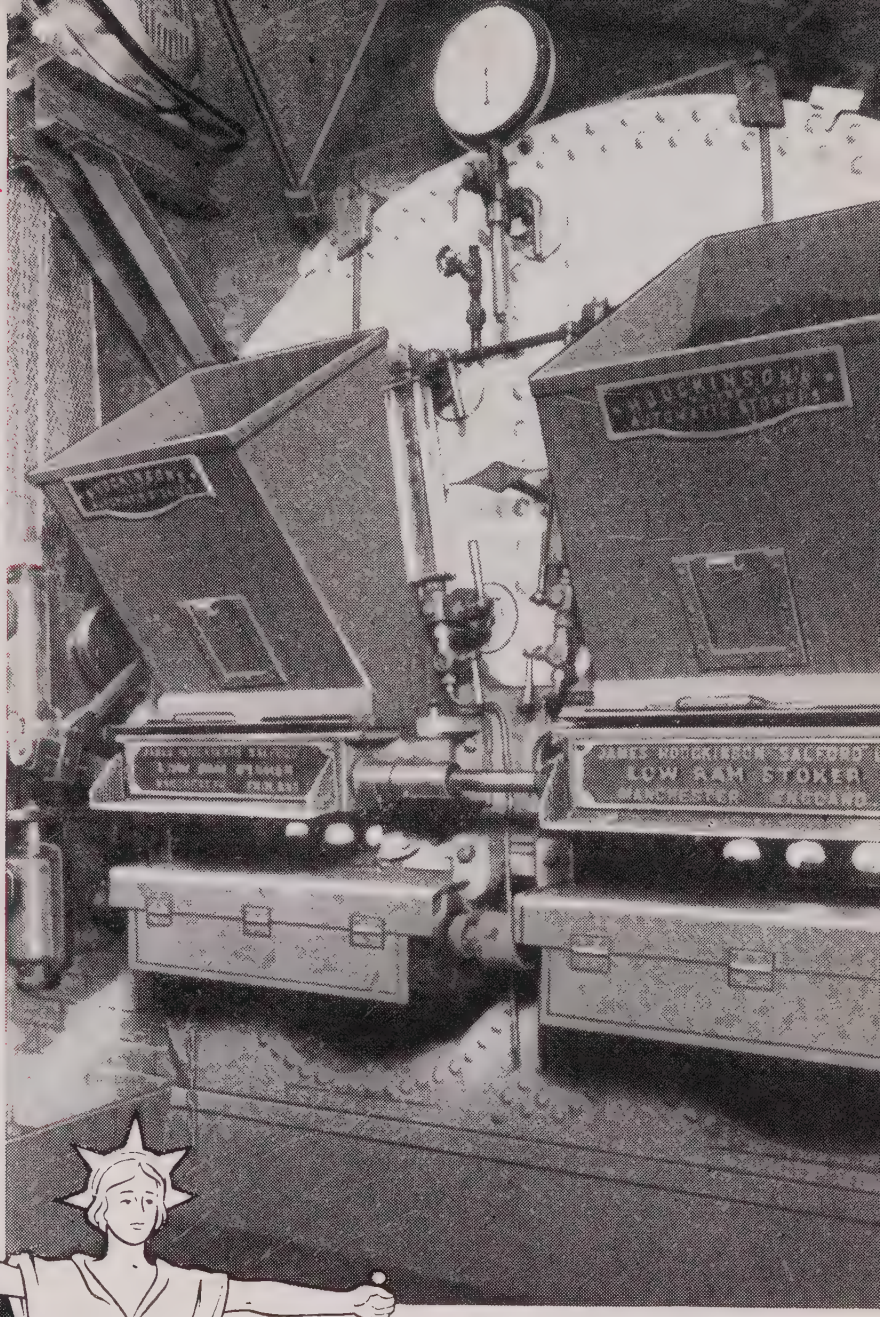
stores heat at night for use next day

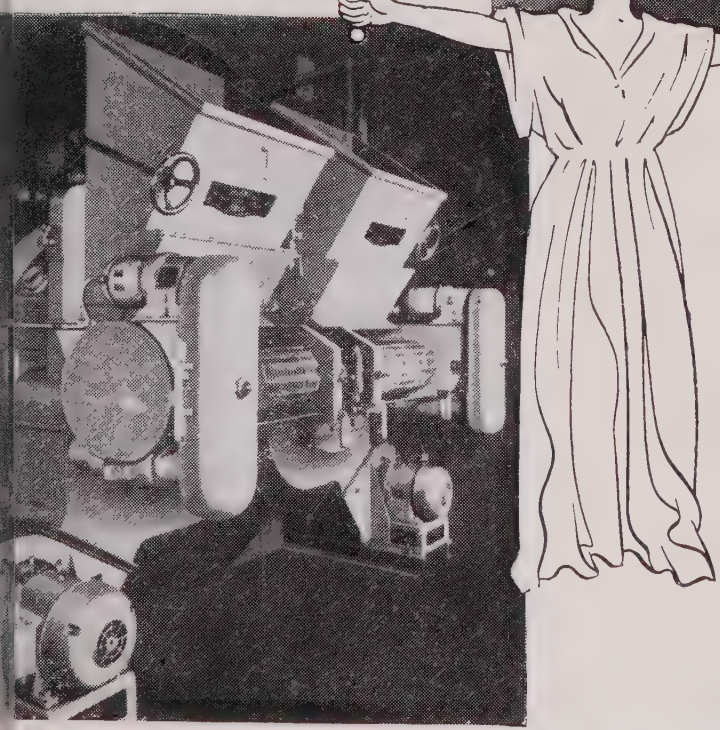


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THE SMOKE ABATEMENT JOURNAL



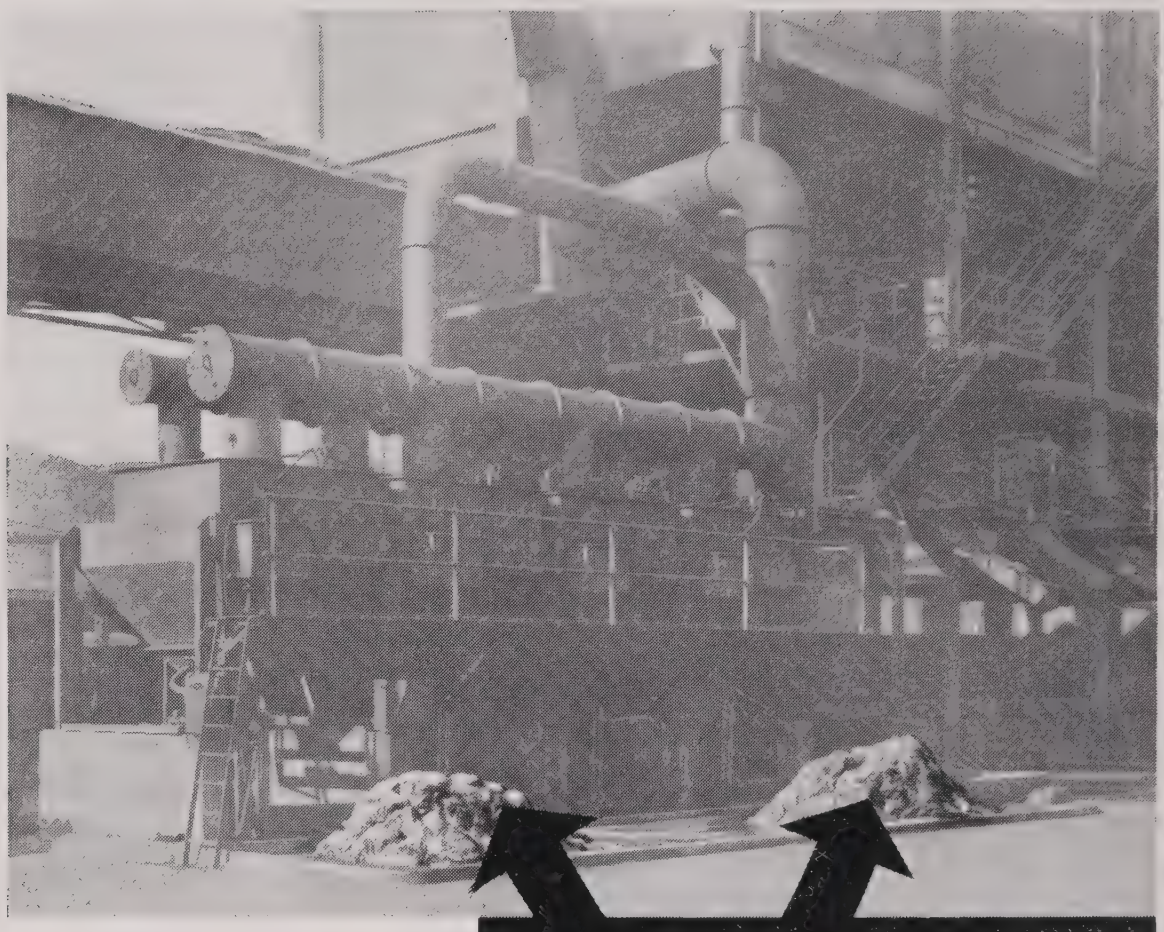
No. 93 SPRING 1955

ONE SHILLING

In this Issue

Quick March !
Sir Hugh Beaver on Clean Air
The Clean Air Bill Debate
Air Pollution from Road Vehicles
The Availability and Efficient Use of Fuel

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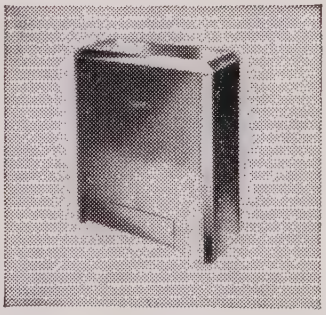


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Anybody concerned with promoting the cause of smoke abatement is invited to take full advantage of the free facilities offered by the Association.

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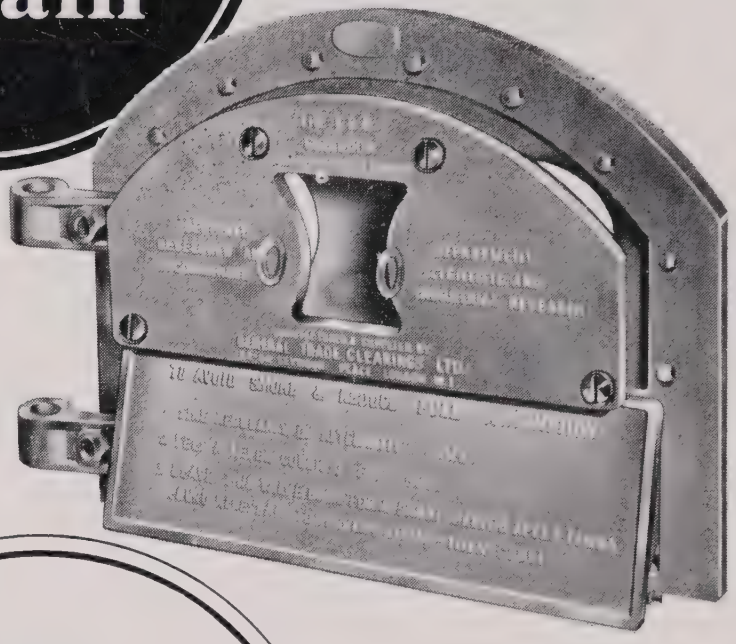
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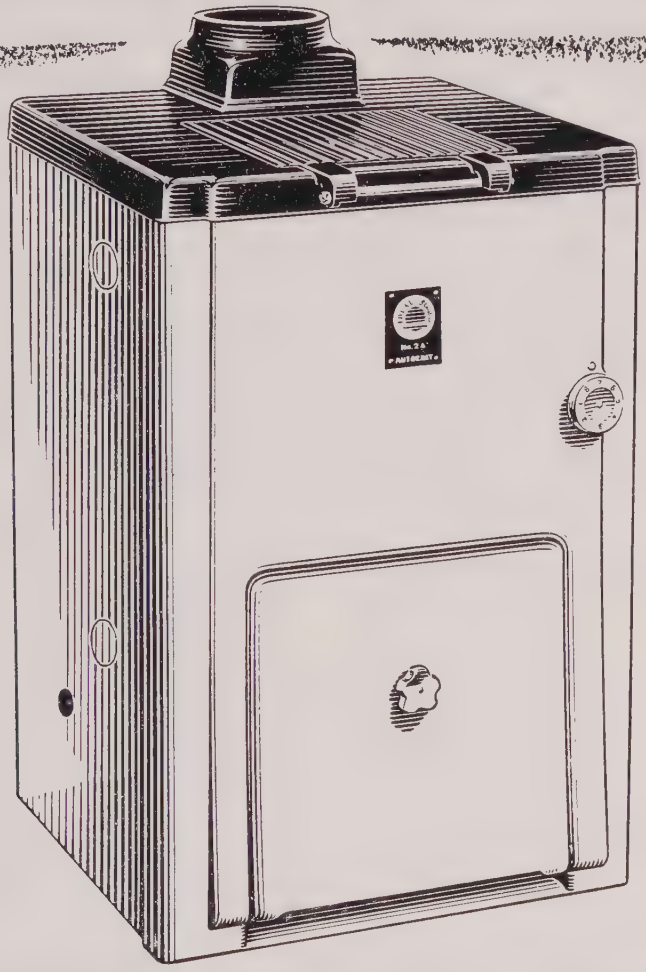
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List price complete **£34** *with stoking tools*

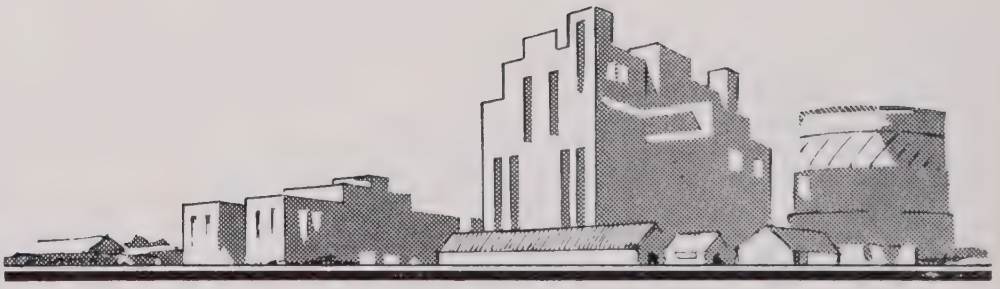
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SOLID SMOKELESS FUELS

The Solid Smokeless Fuels Federation

is a group of organisations responsible for practically the total production of solid smokeless fuels in Great Britain, amounting to 38,500,000 tons per annum. One of the main objects of the Federation is to ensure that solid smokeless fuels are used as efficiently as possible. The combined technical and scientific resources of the Federation, in association with appliance makers, are continually employed in developing high efficiency equipment both for the home and for industry.



The advantages of Solid Smokeless Fuels

Solid smokeless fuels give a *higher* proportion of *radiant* heat than household coal. Consequently you get more useful heat from approved domestic appliances at a *lower* cost for fuel.

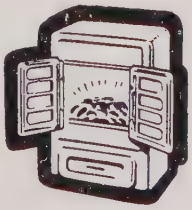
Appliances designed for solid smokeless fuels provide easy and accurate control of the rate of burning and heat output. This makes them extremely economical to run, and capable of long burning periods and overnight banking, thus saving work and attention.

Solid smokeless fuels are graded in a wide range of sizes and in a variety of types to ensure satisfactory performance in all domestic appliances.

Modern solid smokeless fuel appliances usually incorporate a built-in gas burner or gas poker. Lighting up is therefore simple, clean and convenient. No wood or paper is required.

These fuels are smokeless and sootless. They save dirt and work in the home and help to keep house furnishings and paintwork clean.

Solid smokeless fuels are conducive to better atmospheric conditions and improved standards of health.



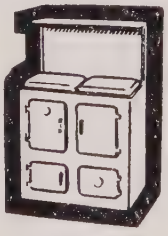
Which are the Solid Smokeless Fuels?

They comprise chiefly (1) the natural smokeless fuels, Welsh Anthracite and Dry Steam Coals, and (2) the manufactured smokeless fuels, Gas Coke, Hard Coke, Low Temperature Coke (''Coalite'' and Rexco) and Carbonised Ovoids. The natural fuels are obtained from underground coal seams. Both are dense fuels with a low ash content providing highly desirable long-burning properties. The manufactured fuels result from the carbonisation of coal in retorts or ovens, whereby the smoke-producing substance present, known as its ''volatile content'', is converted into gas and tar, the source of valuable by-products for use in home and industry. Carbonised Ovoids are marketed under the trade name of ''Phurnacite''. They have a uniform shape, a low ash content and are very similar in burning properties to Anthracite.



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Abolish smoke with solid smokeless fuels and get better heating in the home

S.15

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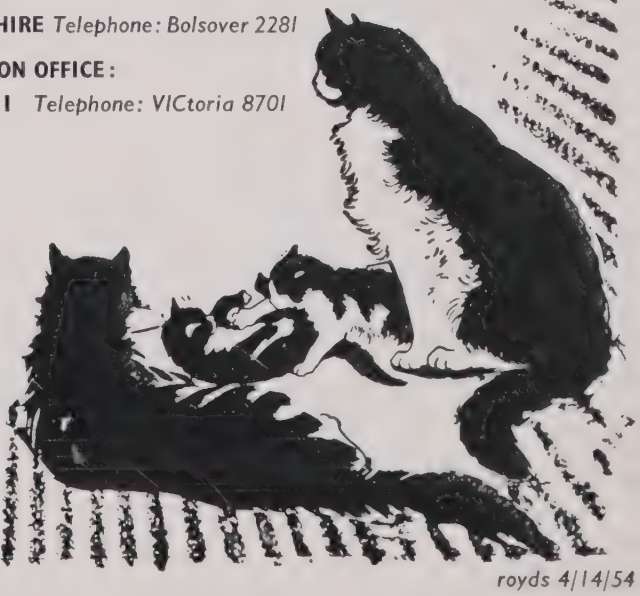
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SMOKELESS AIR

Vol XXV. No. 93 Spring, 1955

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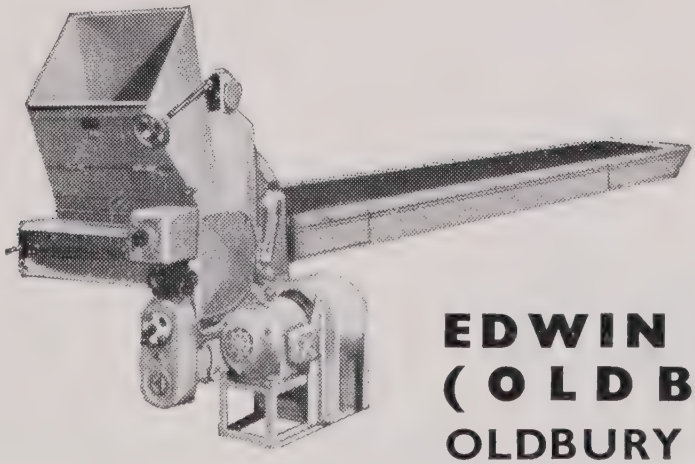
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SMOKELESS AIR

WHEN Sir Hugh Beaver prefaced his Chadwick Lecture on clean air by saying that events had moved so rapidly during the last few weeks that it had been difficult to prepare the lecture, he had our instant sympathy. This is the ninety-third issue of *Smokeless Air* and it has been the most trying of all to produce—so much happening, so much being spoken and written, so much calling for comment, and withal so little time for the job. Not only have we had the Government's acceptance of the Beaver Report, the Nabarro Bill and the Government's undertaking to introduce legislation this session, but other events and portents of importance have crowded in. Thus the plan for railway modernization, with electrification and dieselization, and the foreshadowing of the end of the coal-burning locomotive, is exactly what we have been urging for so long. The great scheme for nuclear generating stations, just announced, marks the beginning of a revolution in the production of electricity that will help in more ways than one to give clean air. The many discussions on the Beaver Report that have taken place might all have been reported at some length in these pages—particularly the meetings of the Institute of Fuel and that of the Royal Sanitary Institute—and even as these notes are being written an interesting air pollution debate in the House of Lords is reported. Press cuttings, every one of which must at least be scanned, have

been flooding in at several hundreds a week (and incidentally are costing a pretty penny).

The Missionaries

One of the most unusual things that is happening is the way that the Beaver Committee, though now officially dead, refuses to lie down. Led by its untiring chairman, its members seem to have converted themselves into a zealous band of missionaries who are determined to maintain the pressure of their report and to clear up any misunderstandings or misgivings. Sir Roger Duncalfe, the deputy chairman, for example, followed Sir Hugh at the R.S.I. meeting with a remarkable and eloquent statement (one almost wrote confession) on how his work on the committee had opened his eyes to the evil of air pollution. Dr. Foxwell vigorously led the discussions at the big Institute of Fuel meetings, and in many smaller meetings members of the committee have spoken, argued and persuaded. There is a reason for this, a reason which explains why the Society has struggled on for so many years, sustained by a small band of people who, having studied it, *knew* what the problem really meant. Now, the members of the Beaver Committee know, and their attitude has become the same.

Appreciation

We think our members will appreciate as much as we have done the frankness of the journalist in a Manchester paper who said: " For years the National Smoke Abatement Society, whose members are now revealed as anything but the long-haired lugubrious gentlemen we once thought them to be, have been trying to get rid of apathy by telling propaganda." We must also acknowledge the thoughtful comment of *The Medical Officer*, which congratulated the Society, the Beaver Committee, medical officers, sanitary inspectors and others " who have preached the evil of smoke until at last a public opinion which cannot be gainsaid has been built up." It added: " How pleased must be the spirits of Dr. Des Vœux, Charles Gandy, and the late editor of this journal, Sir George Elliston, who in their times spearheaded the attack."

We must also thank Mr. Noel-Baker, M.P., former Minister of Fuel and Power, for both a tribute and making public an item of news that had not been formerly published. This will be found in the report of his speech in the Nabarro Bill debate, on page 167.

Lord Horder

We are very pleased to be able to announce that Lord Horder, a Vice-President and a member of the Society for many years, has agreed to the wish of the Executive Council that he should at the next elections be nominated as President, to succeed Sir Ernest Smith. The term of office is limited to two years and Sir Ernest retires at the annual general meeting in September.

Bournemouth

Some preliminary information may be given about the annual conference to be held at Bournemouth on September 28th to 30th. The Des Vœux Lecture will be given by Dr. Alfred Parker, who, as Director of the Fuel Research Station, needs no introduction to members of the Society. His subject will be a survey of the destruction of materials by smoke—the corrosion of metals, erosion of stone and fabrics, and so on. There is much evidence available, and it will be of great value to have it brought together, evaluated and compared in a single paper by so authoritative a lecturer. Two sessions are to be devoted to what was to be " Local Authorities and the Beaver Report," but which now looks like having to be " Local Authorities and the New Legislation." There will also be a session of short papers and reports under the general title of " Progress in Domestic Heating."

The Smog that Wasn't

The B.B.C. in an hour's programme on February 15th, entitled " Smog," provided an outstanding disappointment. Nine-tenths of the time was devoted to the traffic problems of fog, which are of course much the same in clean as in smoke-filled fog. There was a brief interlude of extracts from the Beaver Report and a few grim moments in a hospital, but nothing at all to demonstrate what it is most necessary to bring home to the public: that the occasional smog, serious though it is, is less of a menace to health and less costly economically, than is the day-after-day, year-after-year, consequences of our polluted air. Traffic delays in fog, about which we can do little anyhow, are only a fleabite compared with this.

The New Fumifugium

One of the pleasantest tributes to the Beaver Committee is that made in an account of the report in an Italian newspaper. It compares Sir Hugh Beaver with " Sir John " Evelyn, and calls the report " the new Fumifugium."

Oil Conversions

One of London's best-known fuel distributors, Charrington's, is now distributing fuel oil for domestic use, and an exhibition of oil-burning equipment at their showrooms in Henrietta Place, W.1, was opened recently by Lord Mottistone. The burners shown are all for firing existing boilers, and with their automatic feed and thermostatic control they are excellent appliances for promoting a trend that appears to be growing fast—the replacement of coke and other solid fuel by oil. Charrington's are distributing the Vaccum Oil Company's domestic fuel oil in a fleet of road tankers, those to deal with the domestic market being fitted with a metered discharge equipment that has an automatic punch-card mechanism which records the quantity delivered. On the same day, in the House of Lords, during a discussion on the Beaver Report, Lord Munster (Minister without Portfolio) announced that during the next few years the Ministry of Fuel and Power intended to convert the heating of public buildings from coke to oil. The considerable quantity of coke released would then be available for the smokeless areas. These developments are to be welcomed. Provided that equipment is properly maintained and adjusted, and that a constant quality is used, oil is an excellent smokeless fuel. The more coke it can release from hot water and central heating boilers, of all sizes, the more there will be for the open fire. Incidentally, the Society has recently welcomed its first member from the oil industry—Shell-Mex and B.P. Ltd.

Smokeless Zones

Smokeless zones continue to be discussed and planned by more and more local authorities. The need for co-ordinating their introduction may come much earlier than might have been expected. Nottingham, Birmingham, Aberdeen, Stockport and Smethwick, with several London boroughs, are all going ahead or discussing their plans. The changes that are involved when smokeless zones are started, especially in residential areas, are obviously liable to present problems, and in two of the newest zones, Bolton and Salford, difficulties have been reported in the local papers—possibly over-reported because they make a novel news story. We understand that these teething troubles have been resolved and in a sense they are not without their value. There is clearly a need, whenever a smokeless zone is being started, for thorough explanation, assistance and general publicity beforehand—starting some months beforehand, in fact. There must also be complete co-operation with the fuel distributors and with those responsible for any conversion of appliances, and a service available to help anyone in difficulty. Finally, we would suggest that smokeless zones should never be started in the winter. May or June is by far a better time.

QUICK MARCH!

NEVER has progress towards cleaner air been made more rapidly, and indeed dramatically, than during the last few weeks. Not only has the Government announced that it accepts the principles of the Beaver Report, but it has undertaken to introduce during the present session of Parliament the legislation needed to implement the Report. It is impossible to do more than surmise how much of this welcome alacrity was influenced by the bold and sagacious action of Mr. Gerald Nabarro, M.P., but in all probability this was the impelling factor. Indeed, the Minister of Housing and Local Government, Mr. Sandys, said in the debate on Mr. Nabarro's Bill: "Let me say straight away that if my Hon. Friend has been pushing us along a little, nobody resents it less than I do."

Mr. Nabarro, whose pertinacious concern for fuel efficiency and for a national fuel policy, and through this for a major smoke prevention programme, is second to none in the House, was favoured by the extraordinary good fortune of drawing first place in the ballot for Private Members' Bills just after the publication of the Beaver Report. He at once decided to use this opportunity to introduce a Clean Air Bill, and invited the Society to give him its support and aid. This the Society was glad to do, although without necessarily endorsing all the details of his Bill.

The Executive Council had the privilege of the presence of Mr. Nabarro at a meeting on January 27th, at which he explained his objectives and the position that had been reached, and answered many questions. The Council afterwards unanimously passed the following resolution, which was submitted to the Ministers concerned and published:



Gerald Nabarro, M.P.

"The Executive Council of the National Smoke Abatement Society declares its firm support for early and effective action on the lines recommended by the Beaver Committee on Air Pollution. Recognizing that this necessitates the introduction, without delay, of legislation, the Council:

(1) Welcomes the stimulus to such action by Mr. Gerald Nabarro, M.P., in using his first place in the ballot for Private Members' Bills to introduce a Clean Air Bill, and

(2) Urges that during the present session of Parliament H.M. Government should without fail either: (*a*) Accept responsibility for adapting and supplementing Mr. Nabarro's Bill, *or* (*b*) substitute for it a single comprehensive Government measure."

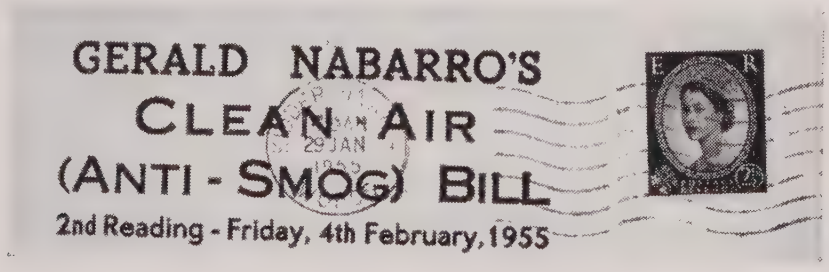
In the outcome what may be called the Nabarroean strategy has proved to be most successful. It has provided invaluable publicity, following hard on the heels of the Beaver Report (and

by publicity we include the attention, thinking and discussion it engenders); it has accelerated Government consideration and decision; made possible a useful debate in Parliament; and, in the Bill itself, there has been an excellent exercise in focussing attention on the problems and controversial aspects that are bound to be encountered as the Government prepares its own Bill and hears the representations of the various interests affected.

The Nabarro Bill was criticized as being incomplete and in some respects defective. Considering, however, the speed with which it had to be prepared it was sufficiently sound to have enabled it to be extended and amended in the Committee stage into a satisfactory measure—if that had been necessary. (The criticism that was made that it was handicapped by being a Private Member's Bill is not necessarily a valid one: when a Bill has passed through all its stages there may be nothing to show how it originated).

Elsewhere in this issue we report the debate on the Bill, with Mr. Nabarro's own review of its provisions (we are sorry not to be able to include the whole of his admirable speech), and the Minister's statement given in full, together with excerpts from each of the other speeches. On the whole it was a debate of good quality, and it is especially encouraging to find that the subject is maintaining the freedom it has always enjoyed from party divisions. This means, among other advantages, that the Government Bill, when it is introduced, will be considered on its merits and that its passage will be facilitated, as was indicated, by the Opposition. Even if it does not reach the statute book this session, and if an election should intervene, it may be taken that the next Government, whatever its colour, will see it through.

The terms of the Government Bill will be awaited with eagerness. To judge from the discussion that is in progress on the Beaver recommendations there is likely to be general approval for the greater part of the measure and some controversy on a few matters that are of considerable importance. These are examined on another page.



Mr. Nabarro's publicity methods, including the now famous envelope franking, aroused much comment and thus achieved their purpose

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The Bristol and District Regional Smoke Abatement Council met in Bristol in November last, and appointed Mr. J. J. Milton as Chairman. Other officers are: Vice-Chairman, Mrs. C. I. Rossiter; Hon. Treasurer, Mr. T. R. Johnson; Hon. Secretary, Mr. F. J. Redstone; and Hon. Assistant Secretary, Mr. G. Dhenin.

The film "Guilty Chimneys" was shown, followed by a talk on coke-burning industrial equipment. A visit was also made to Electricity House, where the members were given a demonstration of a new appliance which provides refrigeration and supplies hot water for domestic purposes. Installed in a domestic larder, the unit maintains the temperature of the whole space at approximately 40 F., and in addition maintains 30 gallons of water at about 140 F., sufficient for all bathing and washing facilities in the average household.

THE BEAVER REPORT

(1) A Review of the Discussion

The considerable discussion that is in progress on the Beaver Report now has added urgency as a result of the Government's assurance that a comprehensive Bill will be introduced this session. The following is a report on this discussion, which as objectively as possible attempts to summarize the *pros* and *cons* of those aspects of the Report that have been criticized or have excited controversy.

Although points of disapproval or opposition are bound to create most interest and attention it must not be overlooked that the remarkable thing about the Beaver Report is the extent to which it has been accepted. No one has complained of what one journal called its " forceful, almost angry " tone, and only one or two voices have queried either its analysis of the problem or the conclusions on which are based its demand for prompt and comprehensive action. Mr. Michael Higgs, M.P. for Bromsgrove (see page 161) appears to be unique, at least as far as " informed " opinion is concerned. More seriously Dr. Somerville Hastings and one or two of his colleagues contend that nothing matters other than sulphur gases. That, however, is about all the *general* criticism that has emerged, and it may therefore be concluded that at long last there has been achieved the establishment of an accepted national policy for clean air—a position for which the National Smoke Abatement Society has been working for so long.

Even among the detailed recommendations, any of which were obviously likely to be challenged, it appears that all but a very few have been approved. Those that have been disputed are, however, of some importance, and in particular recommendation No. 3 is being attacked and defended.

This reads as follows:

> " In the case of certain industrial processes in which the prevention of dark smoke, grit or harmful gases presents special technical difficulties, responsibility for ensuring that the best practicable means of prevention are used at all times should be vested in the Alkali Inspectorate, and the provisions of the Alkali Acts should be extended accordingly."

The Beaver Committee and those who now support this recommendation appear to depend on the following arguments:

(*a*) The control of the special processes requires a relatively small, but highly trained, inspectorate. It would not be practicable for local authorities individually to employ such men, and therefore a central inspectorate cannot be avoided.

(*b*) It will take time to train a corps of men of the right calibre and this can be done more rapidly and effectively by a central body than by a large number of local authorities.

(*c*) A central inspectorate could make possible standard practice throughout the country, and it could be readily kept up-to-date on new and improved methods.

(*d*) The local authorities will have their hands full in dealing with their increased responsibilities as proposed elsewhere in the Report, and this may not be done so well if in addition they have to contend with the special processes.

To this the opposition replies as follows:

(*a*) Effective prevention of air pollution calls for intimate knowledge of local problems and conditions, including awareness of local public opinion, and this can only be achieved by officers of the local authority.

Prompt, personal action can be taken only by the man on the spot.

(*b*) Consultants can be called in for unusual and especially difficult problems, and existing co-operation with the Alkali Inspectorate can be maintained and developed.

(*c*) The case of the smaller authorities, who could not usefully employ specialist inspectors, could be met by joint committees or similar regional groups.

(*d*) Dual control of air pollution is bound to be wasteful and must increase the manpower difficulties likely to be experienced during the next decade or so.

The Society, in its memorandum to the Beaver Committee, did not differentiate between different classes of process, but on control suggested:

" All local authorities to be required either to employ fully qualified smoke inspectors according to requirements to be prescribed, or to combine with other local authorities in Joint Air Pollution Control Committees employing such inspectors. In the event of neither of these alternatives being adopted the duties to be carried out by the County Council."

Mr. Nabarro, in his Bill, sought to achieve a compromise on the matter by proposing that the special processes should be the responsibility of the Alkali Inspectorate, *except* in the case of local authorities who possess the necessary facilities and technical staff —the Ministry to decide whether or not this was the case. This seems to have met with some approval, although it has been criticized because it would create an administratively rather untidy situation.

Prior Approval

The Society and other bodies in their evidence to the Beaver Committee urged that prior approval should be required for all industrial fuel-burning plant. Industrial interests, and particularly the Federation of British Industries, have opposed this principle. The Beaver Report's recommendations on this are as follows: (1) Prior approval for all pulverized fuel plant and for any other solid fuel installations burning 10 tons or more per hour, but with reference to grit emission only. (2) Prior approval for all the special processes it is proposed should be under the control of the Alkali Inspectorate. (3) " Voluntary " prior approval for other installations. By this is meant the provision that is already included in a number of Local Acts where it is laid down that new installations must be capable of being operated smokelessly, but that action for default cannot be taken *if* prior approval had been requested and had been granted. This procedure is not without value, but disappointment has been expressed that straightforward prior approval has not been recommended for just the one sector of industry that many believe is the one where it will be most useful. If it is desirable for the special processes, for pulverized fuel plant, and for grit prevention generally, it is asked, what principle makes it undesirable for ordinary steam-raising plant in respect of smoke? It means, it is argued, that the small factory owner is still free to install any old plant he pleases (literally, perhaps) without any technical advice. If a smoke problem is the result time and money will have to be devoted to controlling it (or dark smoke may be avoided by the simple expedient of diluting it with excess air!)

In reply, it is said that under the proposed new legislation, with its stricter control and higher penalties, this voluntary prior approval will be asked for and will be sufficient. To which the critic may ask, in effect: " If that is so, why not let it be obligatory, as in the other cases? To whose benefit is it that it should be voluntary? "

It has been said that industry does not like compulsory prior approval because it may mean the examination of secret processes. But surely secret processes are more likely to be found among the special installations to be subject to prior approval by the Alkali Inspectorate, who in any case have been exercising prior approval for

many years for the processes they already control? It is felt that there is something illogical and timorous about the Report's thinking on prior approval.

The only other legislative proposal that appears to be causing concern is No. 7—financial assistance for conversions in smokeless zones and smoke control areas to be given by local authorities and the Exchequer. This is very much a matter for discussion and agreement between the parties concerned, and the Government's views will no doubt be known when the Bill is published.

The other recommendations seem to meet with full approval from all quarters. There is some questioning about the new idea of " smoke control " areas, and particularly about the low volatile solid fuel other than smoke less fuel that will be permitted in them. Where is this fuel? it is being asked.

Stoker Training

There are fifteen recommendations in the Report that, although they do not require legislation, are of great importance. They are, to a large extent, of a technical nature and depend in part on Government policy. Each could be the subject of a full-length discussion. Only one has been criticized from a purely smoke abatement viewpoint, and that is No. 3, which deals with the recognition of stoking as a skilled operation and to the proper training and remuneration of stokers. It is not what is said in the brief recommendation, but what is not said, that is questioned. There is no proposal for the certification of stokers, even by stages, but merely (in the earlier discussion, para. 31) that: " we look forward to the time when every boiler plant and furnace will be tended by fully trained and competent firemen."

Secondly, in discussing the training of firemen (para. 32) the Report urges the provision of a limited certificate of competence to be granted on a practical and oral test alone. This has been defended by members of the Committee as being adequate and simple, and more helpful for men who are not accustomed to written examinations. The critics point to the limited certificate of competence that already exists, but which was not mentioned by the Committee—the City and Guilds Boiler Operators' Certificate—which is proving to be highly successful, and is regarded as being much more satisfactory because in addition to a practical-oral test it includes a simple form of written examination. This, it is claimed, is fairer and more satisfactory than relying upon an oral test only—especially for the man who may be flustered by oral questioning and who likes time to think out his answers. As evidence, it is pointed out that out of 709 candidates in the 1954 examinations for the B.O.C., 73 failed in the practical-oral test, but only 21 in the written part.

(2) The Report and Public Opinion

The Society's memorandum to the Beaver Committee concluded by referring to the importance of public opinion, and said that their report itself could " provide an exceptional and most important opportunity for making a sharp and compelling impact in responsible quarters and among the public generally; an impact we believe to be urgently necessary."

To judge by the press reaction—which taken as a whole may be regarded as a fair reflection of public opinion—such an " impact " has been achieved in a remarkable and almost unanimous manner. The strong impression that has been made appears to be due to the firm and outspoken quality of the report regarded as a whole. The first positive achievement of the report appears therefore to be that the importance and urgency of the problem have become more widely accepted than ever before, and that

this constitutes an important step forward in the development of public opinion.

The kind of impression that the report created can be judged by the tenor of typical editorial comments. Thus it is " a quite remarkable document " (*Star*), " stern and sensible " (*Glasgow Herald*), " radical and realistic " (*Local Government Chronicle*), " a particularly positive document " (*Colliery Guardian*), " far exceeds expectations " (*Bristol Evening Post*), and is both " forthright and comprehensive " (*Scotsman*) and " brave and comprehensive " (*Electrical Times*).

The Builder said that the Committee had not burked the difficulties and that " The National Smoke Abatement Society must be feeling satisfaction that the policies they have so long advocated have come visibly nearer to being put into operation."

The Lancet makes a complimentary diagnosis by declaring that " no verbal anaemia afflicts the Beaver Report . . . a Victorian robustness that smacks of Chadwick." *Modern Transport* found it " forceful—indeed, somewhat angry in tone," while *Electrical Times* was not alone in the view that " we called the interim report half-hearted. The final more than restores the balance."

The Times was characteristically cautious: " The value of this final report is that it goes some way towards providing a practical programme, though it requires legislation." Nevertheless: " Now that the Beaver Committee has reported the Government can have no excuse for further delay."

The *Manchester Guardian* made a practical point: " It embraces wholeheartedly the Churchillian axiom—so little regarded in this context—that our admitted inability to do everything at once is not a valid excuse for doing nothing." At the same time the report was " open to criticism for not going far enough in some directions."

Fuel Economist viewed the report from its own standpoint and concluded that it was " one of the few post-war fuel reports which is almost entirely objective, and which has produced positive recommendations . . . it lays the foundation not of a clean air policy only, but indirectly of a national fuel policy in which the fuel industries can be co-ordinated. . . . Undoubtedly the best achievement of any fuel committee which has yet deliberated."

Another specialist journal, *Investors' Chronicle*, pointed out that the report " should prove of considerable significance to investors."

Time and Tide seemed nervous and suggested that " the pattern of English domestic life should not be changed too rashly," whereas the *Economist* was disappointed: " It is a pity that the Committee did not explore the possibility of imposing new taxes on those who contribute to the social nuisance of smoky fog."

The *Evening News* (London), after praising the report as a " first-rate document, vigorous, practical and far-seeing," made an important point about a danger to be avoided: " the tepid approval which leads to pigeonholing "

This was a danger we had been afraid of. It has happened so often. But in this case it has been successfully overcome. There is, as is inevitable, criticism of some details of the report, and disappointment here and there, but there appear to be very few who do not consider the report as a whole to deserve the warmest approval and support.

The Russian Health Ministry's journal *Medical Worker* has called for a special commission to investigate air pollution. An editorial states: " There have been many press complaints about the air being dirty in the big cities. During the last ten years this condition has become more aggravated because of the increasing number of cars and the growth of our industry. . . . It is very bad that not a single institute trains specialists in the practice of purifying the air."



THAT DARKNESS AT NOON

THE smoke cloud that passed over London and moved down to the south coast on Sunday, January 16th, was a somewhat unusual one, mainly because of its density, the speed at which it moved and the alarm it caused. It was due to an accumulation of smoke over northern London in cold air underlying a warmer cloud layer. A south-easterly wind was pressing it towards a cold front approaching from the north, and at about 1.30 p.m. the mass of yellowish smoke-laden air began to retreat southwards, followed by the cold northerly wind. Darkness was intense in places, coming rapidly but lasting only for a short time. The smoke travelled south, being seen at Bromley, Kent, Croydon, Epsom, Guildford, Godalming, Reigate, East Grinstead, and finally Hastings, before it passed over the Channel. The total width was estimated to be at least 20 miles, and at its densest some two miles deep.

It certainly was an eerie phenomenon and provided some sensational headlines and stories for Monday's papers—crying children, screaming women, a praying woman kneeling on the pavement with her child, a bearded man proclaiming that the end of the world was at hand, and so on. Perhaps the choicest touch came from the fruit seller in the Strand, who said that for ten minutes he couldn't see an apple in front of him. Some, according to one paper, blamed it all on the hydrogen bomb.

Smoke trapped beneath an inversion layer, creating darkness, is of course frequently experienced, and night-time blackness is not uncommon. One of the significant facts about this occurrence is that it happened on a Sunday, when practically all the smoke must have been of domestic origin. It was first-class propaganda, and in view of other events could not have been more timely.

The *Daily Mirror* photograph above shows Piccadilly Circus during the black-out.

THE AVAILABILITY AND EFFICIENT USE OF FUEL

Excerpts from a recent Paper by

K. T. Spencer, C.B.E., M.C.

Chief Scientist, Ministry of Fuel and Power

ALL industrial production depends decisively on fuel and power. British industry grew up and became a leading influence in the world in an age of cheap and abundant coal. So far as we in this country are concerned, that cheapness and that abundance have gone for ever. Atomic energy may falsify this prophecy, and it is to be hoped that it will. But as yet we cannot count on it doing so. In any event many years must pass before atomic energy could replace coal as our main source of energy. We must face up to a continuing fuel shortage during those years; we must identify its implications and we must shape our plans and actions accordingly.

Before considering some of these implications, I want to drive home the facts about the present fuel and power situation and how that situation has come about during the last generation or two. The facts are well-documented, but even now they are not widely enough realized.

Britain's first recorded fuel crisis occurred in the 16th century. Although coal had been mined in small quantities since at least the 14th century and some power was obtained from windmills and water-wheels, the general fuel at this time was still wood.

According to G. M. Trevelyan (Social History of England), the 16th century was notable for a great expansion of mining of all kinds. In the smelting of the ores, particularly iron ores, vast quantities of wood and charcoal were burned and the timber resources of the country were drained away. Household heating and cooking depended normally on wood, as did the manufacturing industries, and, as local supplies became exhausted, we are told that many a cottager had a cold hearth and a bread-and-cheese diet and the output of the manufacturers was sorely restricted. Some works, including those of the new glass industry, had to move around and follow the woods. It was during the period 1550 to 1600 that coal started to come into much greater use to supply the deficiencies, though this was limited to localities near to the pits or near to navigable water. In 1578 it was said that " brewers, dyers, hat-makers and others have long since altered their furnaces and fiery places and turned the same to the use and burning of sea-coal." A premature and unsuccessful attempt was also made at this time to smelt iron with coal.

During the period 1750-1800, in return for manufactured goods, the North American colonies sent us timber and pig iron. Timber and iron were also imported from the Scandinavian and Baltic countries because eighteenth century England, having exhausted its natural forests, was short of timber for ship-building, house-building and fuel. Although coal was now largely filling the fuel deficiency for domestic heating and many manufacturers, it was only beginning to be applied on a large scale to the smelting of iron. " And so, in spite of England's potential wealth in iron ore, much iron was imported from lands which still had virgin forests to burn."

The development of the industrial revolution is familiar history. It is sufficiently well known that, with the application of coke to the smelting of iron, and the rapid expansion of the iron industry and industrial activity generally which followed, there was a sharp rise in the consumption of coal, reaching a pre-war maximum in this country of 200 million tons in 1916.

At the same time, up to the commencement of World War I, coal was exported in ever-increasing quantities, reaching a maximum of 98 million tons in 1913.

The effect of industrialization was gradually to alter the entire economy of the country from self-sufficiency to extensive reliance on imported food and raw materials. At the present time, 50 per cent. of our food is obtained from abroad and we have come to depend more and more on the importation of raw materials, not only to satisfy the needs of a much bigger population, but also because many native resources, for example lead, tin, copper and timber have been virtually exhausted.

Manufactured goods have therefore to be exported in ever-increasing quantity, in the face of growing competition from the more recently industrialized countries, particularly the U.S.A., whose manufacturing capacity and resources of raw materials and energy are vastly greater than our own.

In order to survive at all, the flow of manufactured goods has to be maintained and increased and we have only one indigenous resource with which to provide the energy required by the manufacturing industries. But coal production has not kept pace with the growing needs of our factories. Thus we are again approaching a situation similar to that of the 16th century.

Although the coal reserves of Great Britain are believed to be enough for at least the next two hundred years, coal is no longer being produced in the quantities needed.

The National Coal Board, in drawing up its plan for reconstruction of the industry, originally estimated that by 1965 the total inland demand for coal would be 205-215 million tons a year and the export demand 25-35 million tons. Therefore the plan aimed to increase total production to 240 million tons in 1960-65. Later the Ridley Committee made an independent estimate of probable coal requirements. On the bases of past trends in all branches of coal utilization and making allowance for improved efficiency in utilization, the Committee estimated that in the period 1959-63 the inland demand for coal would probably be some 230 million tons per annum, roughly 20 million tons greater than the National Coal Board figure. In the light of the Ridley Committee's estimate the coal production plan was revised, and the aim is now to produce 260 million tons annually in the period 1961-1965.

In the last three years, despite continued restrictions on domestic coal, inland consumption of coal has been running at more than 200 million tons. In the current year 4 million tons are to be imported as a precautionary measure, since it is now estimated that inland coal requirements in 1954 will be 7 million tons greater than in 1953. It is conceivable that within the next decade the gap between supply and demand could increase to the order of 20 million tons per annum. Electricity generated from nuclear energy may eventually come to the rescue, but there is no possibility that aid from this source can materialize for several years.

The gap that will exist between coal supplies and requirements for at least the next ten years has been plainly shown. How is it to be filled? There are three possible ways:

1. Increasing the production of the mining industry.
2. Increasing the importation of fuel, principally petroleum.
3. Increasing the efficiency of energy utilization.

(Mr. Spencer discussed these possibilities, and enlarged particularly on increased efficiency and the prevention of waste, considering in turn the railways, the domestic fire, the collieries, the iron and steel industry and industry in general. We quote a number of points of particular interest).

Railway locomotives' boilers are reasonably efficient; Atlas's boiler had an efficiency of about 45 per cent.; by 1870, 60 per cent. had been achieved;

present-day locomotive boilers have an efficiency of the order of 80 per cent. But there has been no corresponding improvement in the performance of the engine of the locomotive, which has remained almost unchanged since 1845.

By 1920 maximum overall locomotive thermal efficiency had reached about 7-8 per cent. At present certain British Railways locomotives can achieve 10-12 per cent. under optimum speed and power conditions.

The above figures all relate to maximum efficiencies achieved under special test conditions and are in no sense a measure of the practical efficiency achieved in everyday service. A modern express locomotive on daily long distance runs achieves an average overall efficiency between 6 and 7 per cent.; a shunting engine averages under 3 per cent. Overall steam locomotive efficiency on British Railways is probably under 5 per cent. and there seems no prospect of any substantial improvement in the efficiency of the coal-burning locomotive in its present form. Modern railways electrification, however, can convert the energy in the coal to useful work at the train with an overall average efficiency of 19 per cent. This represents a difference between something over $3\frac{1}{2}$ lb. of good coal per h.p. hour on a steam railway system and 1 lb. of poor coal per h.p. hour on an electric system.

The leading authorities in railway engineering and various official enquiries have constantly advocated railway electrification. If it should prove practicable to electrify the whole system, some 13 million tons of large coal per annum would be saved at the cost of an increased consumption at power station of some 5 million tons of poor quality coal.

It is not easy accurately to assess the improvement in steam raising performance in industry over a span of years, since similar types of boilers ought to be compared and allowance made for the advent of mechanical firing and advance in design. with the incorporation of feed-water heaters, air heaters and steam super-heaters. With this proviso, the general picture is as follows:

From John Batey's "Steam Boilers and Combustion" a test is recorded of a Galloway boiler of the Lancashire type carried out in 1874, showing an evaporation of 8.77 lbs. of water per lb. of coal actual or 10.4 lbs. from and at 212°F. Up to 1880 only hand-fired boilers were in general service, their efficiencies varying from 50 to 65 per cent. Since the introduction of the water-tube boiler at about this time, the average efficiency of this type has increased to 85 per cent. and an overall efficiency of 90 per cent. can be obtained. The average efficiency of shell-type boilers on full load, however, remains at 65-75 per cent. In the light of these figures, it is interesting to note the results of a survey of steam and power usage carried out by the Ministry of Fuel and Power last year. The survey was limited to the larger establishments, industrial and commercial, using more than 2,000 tons of coal or its equivalent a year, of which there are approximately 4,600 with a total consumption of 63 million tons of fuel a year. These establishments number only 12 per cent. of all establishments consuming more than 100 tons of fuel a year, but they account for 75 per cent. of the total fuel consumed.

The survey showed that over half the boilers in industry are Lancashire boilers and less than one-third water-tube boilers; about half of these boilers are more than 30 years old, more than a quarter being over 40 years old. In the cotton industry 74 per cent. of all boilers are more than 40 years old, nearly all of them being Lancashire boilers. The average efficiency of steam raising by all boilers was shown by this survey to be about 61 per cent. The average evaporation ratio was found to be 6.7 lb./lb., which is less than the test of 1874 which has been mentioned. It would appear that the average

efficiency of the shell-type boiler has increased by about 10 per cent. in the 80 years.

It is not enough to generate energy efficiently in one stage of manufacture merely to dissipate it in a subsequent stage. I am not thinking primarily here of installations or manufacture in which fuel consumption plays a prominent part, but rather of those many thousands of minor processes, machines and services that are consistently uneconomically run. Their inefficiency may be due to many causes: untrained operators, incorrectly rated motors, failure to install automatic control, lack of financial incentive to renew plant, ignorance of best modern practice, to name a few. Each individual case may appear insignificant but the sum of their inefficiency represents a substantial waste of the Nation's resources, and a reserve which must be deployed in this emergency.

To illustrate the scope that exists for improvement along these lines the table below has been compiled giving some random examples of the kinds of situation that research has already revealed.

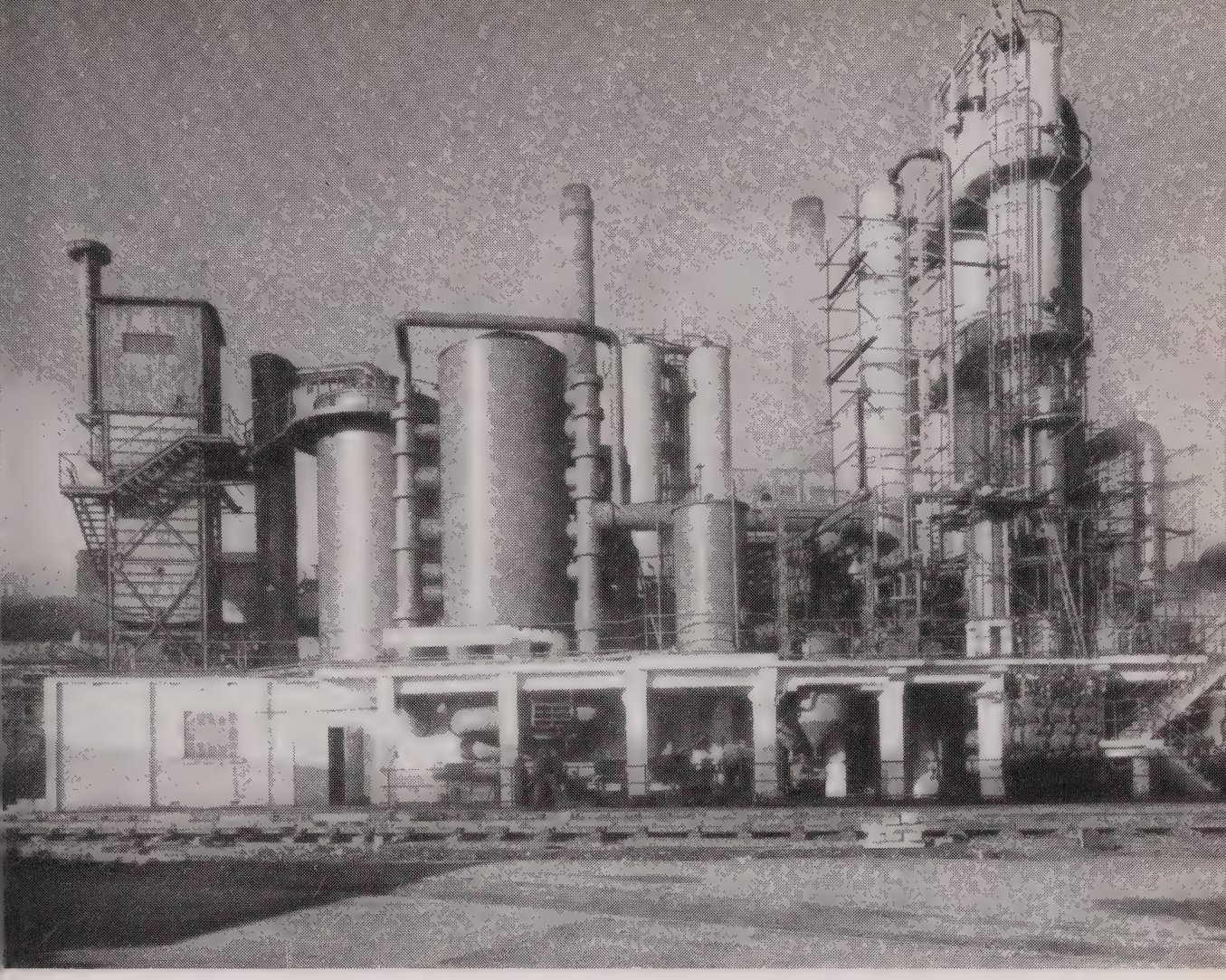
Make no mistake! As a Nation we are up against it in the fuel and power field. But this has its bright side. It is a challenge of a kind which has always hitherto evoked an adequate response. It is up to everyone of us to see that the same happens now. The challenge is in reality a twofold one in that we are both short of fuel and short of money for capital investment. So we must draw heavily on that other resource upon which Lord Rutherford placed his reliance in another connection and I take the liberty of adapting his words to the present context:

" We haven't enough fuel so we've got to think."

Some Comparative Performances of Machines and Plant as Fuel Users

Industry	*Least Efficient*	*Most Efficient*
Pottery ..	Intermittent up-draught oven: 358 therms consumed per ton of earthenware biscuit fired.	Electric multi passage kiln: 17 therms consumed per ton of earthenware biscuit fired.
Pottery ..	Open stillage stove for drying tiles prior to firing: cost per ton of dried tiles=124d.	Tunnel drier using waste hot air for drying tiles prior to firing: cost per ton of dried tiles=27d.
Transport ..	Average steam passenger train: 10.8 lbs. of coal per passenger vehicle mile.	Average electric passenger train: 4.1 lbs. of coal per passenger vehicle mile.
Transport ..	Steam branch line train: 0.48 lbs. of coal per passenger seat mile.	Single-deck diesel road coach: 0.021 lbs. of coal (equivalent) per passenger seat mile.
Transport ..	Steam locomotive freight train: 650 gross ton miles per 10 therms.	Diesel locomotive freight train: 4,000 gross ton miles per 10 therms.
Mining ..	Joy continuous miner: 230 kWh consumed by machine per 100 tons of coal got.	Coal plough: 2 kWh consumed by machine per 100 tons of coal got.
Agriculture ..	Continuous flow grain drier: consumption in B.T.U. per lb. of water evaporated: 6,000.	Ventilated silo grain drier: consumption in B.T.U. per lb. of water evaporated: 1,000.
Lighting ..	Gas lamps: efficiency less than 1 per cent.	Modern electric lamps: efficiency 20 per cent.

The figures given above relate to individual cases of recorded performance and are not necessarily averages.



Sulphur Recovery Plant at Corby

This plant, the only one of its kind in the country, has been installed at the Corby works of Messrs. Stewart and Lloyd. It is the Collin process for the removal of sulphur from coke oven gas. It yields a weekly output of 220 tons of sulphuric acid, and thus makes an important contribution to the problem of how to utilize our indigenous sulphur. Moreover, it recovers 80 per cent. of the sulphur content of the gas, which was previously burned to atmosphere, and is thus a major step forward towards clean air in the district.

S.S.F.F. Exhibition at Charing Cross

The Solid Smokeless Fuels Federation have staged a further attractive exhibition at Charing Cross Underground Station, which was opened by Mr. Joynson-Hicks, Parliamentary Secretary to the Ministry of Fuel and Power at a ceremony on February 1st. As he said, the exhibition was a glowing tribute to the resourcefulness of the manufacturers of smokeless appliances " But to get the best out of our latest weapons we must know our weapon drill. This exhibition teaches us and I hope that many new recruits will pass through the Charing Cross training school in the next fortnight." " Personally," continued Mr. Joynson-Hicks, " I welcome every bit of help we can get with the campaign against air pollution and we shall see that the campaign does not fail for lack of ammunition—smokeless fuel."

The centre-piece of the exhibition was a giant brazier, burning coke. This was arresting, but it may be doubted whether it was wise to renew the association between coke and the watchman's type of brazier, which is largely responsible for the fallacies about coke fumes.



Measuring and Control Apparatus Display

The Society's President, Sir Ernest Smith, recently opened an exhibition of the British Industrial Measuring and Control Apparatus Manufacturers' Association—B.I.M.C.A.M. for short. The exhibition, at the Waldorf Hotel, London, was staged to show the instruments that should be used for the control, indication and measurement that is necessary to ensure the prevention of smoke and efficient combustion. The Hon. L. W. Joynson-Hicks, M.P., Parliamentary Secretary to the Ministry of Fuel and Power, was present and the photograph shows him with Sir Ernest, in front of a smoke recorder.

Personal

Mr. Peter C. G. Isaac, senior lecturer in public health engineering at King's College, Durham University, and a member of the Executive Council of the Society, has been elected as a Fellow of the Royal Sanitary Institute.

Mr. G. H. Barnard, M.INST.F., formerly area engineer to N.I.F.E.S. in Wales, has been transferred to the head office in London, to undertake work that is expected to result from the report of the Beaver Committee.

Mr. W. B. Kennedy, of Manchester, whose paper to a recent Scottish conference is briefly mentioned in this issue, is to be congratulated on his recent writings and addresses. He read a most comprehensive paper on smoke prevention to the Public Works Congress in London last autumn, gave a full-length paper to the North Western centre of the Sanitary Inspectors' Association on the Beaver Report, and a critical analysis of the report in the December 11th issue of the *Surveyor*.

Mr. R. H. Gummer, a Director of International Combustion Ltd., has been elected President of the Institute of Fuel in succession to Dr. W. Idris Jones. Mr. Gummer is a founder member of the Institute and has been honorary treasurer since 1945.

CLEAN AIR

By

Sir Hugh Beaver

A Chadwick Trust Lecture read at the Royal Institution on 14th February, 1955, with Dr. R. Lessing in the Chair.

IT is some months since I was invited to give this lecture under the Chadwick Trust. At that time the Committee on Air Pollution had published its report and it had been possible to see the general lines of public and informed reaction. It was at once clear—or at any rate it seemed likely—that action in some form or other might follow. In fact events have moved very rapidly—so rapidly that I found it impossible to prepare for today any worthwhile reasoned exposition of this subject of Clean Air. I felt impelled to await the outcome of the debate in Parliament on Mr. Nabarro's Bill. The result is that I have not been able to give the time to the preparation of this paper that the great name of Chadwick and the Chadwick Trust, or this famous building, or this audience deserves. I am instead going to put before you certain lines of thoughts which are pertinent to the stage we have now reached.

The Government has announced its acceptance in full of the principles of my Committee's report, and has undertaken to introduce during the present parliamentary session a comprehensive measure to put them into force. The Opposition has indicated that such a measure would have their support. I know how often there is a slip 'twixt the cup and the lip. Nevertheless, I am going to assume that so far as I am concerned, there the matter lies. It seems to me unnecessary today to argue, as one would have done only a few months or perhaps weeks ago, the desirability of preventing smoke. But that does not mean that the problem is solved. Far from it, indeed.

My Committee in presenting its report stated at the outset that " air pollution on the scale with which we are familiar in this country today is a social and economic evil which should no longer be tolerated, and that it needs to be combated with the same conviction and energy as were applied one hundred years ago in securing pure water." Now, I thought first, that it would have been appropriate in a Chadwick Lecture to approach air pollution in exactly this way; to see how far this comparison with the clean water issue was really valid. I am, however, in fact not going to explore that very far; but there are some comparisons and some considerations that are worth making.

As far as I know the arguments of Chadwick and Snow and Simon and others were wholly based on the social and health factors—and very adequate grounds for alarm and agitation did these health considerations afford. There obviously were, or could have been brought forward, some economic grounds; but they would have been of secondary import, and in fact were I believe never thought of. Now very briefly what was the sort of health background to the famous report of 1842 and to the Public Health Acts of 1866 and 1875; and to all the work in the last 100 years for clean water. I am going to give a few facts and figures, very brief and incomplete, but not I think materially inaccurate or misleading.

Perhaps the fundamental recommendation of Chadwick's report was " that the primary and most im-

portant measures, and at the same time, the most practicable, and within the recognized province of public administration, are drainage, the removal of all refuse of habitations, streets and roads, and the improvement of the supplies of water." At that stage indeed the emphasis was on water and indeed rather on increasing the quantity of piped public water, than on its quality, as we now measure water purity.

The Water-Borne Diseases

The two plagues of those days were water-borne diseases—typhoid and cholera. Prior to the passing of the Public Health Act of 1875 the death rate of typhoid, year in year out, remained pretty constant at about 390 per million of the population. In 1878 it fell to just over 300; in 1880 to 250; in 1900 to 175. In 1910 the typhoid death rate was 50 per million; in 1920, 15 per million; and in 1953 5 deaths in 50 million.

Asiatic cholera was sporadic in its attacks. The great "killer" years were 1831, 1848, 1853, 1866 and 1893. In these last four epidemics the total number of deaths known to have been due to Asiatic cholera in this country was 93,127. Clean water and controlled sewerage have now eradicated it except for the occasional imported infection.

Those are staggering figures to be attributed to polluted water. What is the toll of polluted air? I have not the material to present the grisly balance sheet and indeed the figures do not exist. One can only arrive at some approximations. We all know well enough in this country that in the four days of the London Smog of December 1952, at least 4,000 deaths were caused in London. This sudden and ghastly visitation was less dramatic in its appearance and less obvious in its action than a really bad cholera epidemic—partly because it struck chiefly at the elderly and the ailing. A smog like this having once occurred obviously can occur again—it could so far as we know occur any winter's day, with equal or worse effect.

But my Committee did not base its case against air pollution on the London Smog or such abnormal occurrences. I will not quote all the figures we gave. We emphasized the clear association between air pollution and the incidence of bronchitis and other respiratory diseases. We compared this country with Scandinavia and showed that the death rate per 100,000 in this country from bronchitis is almost fifty times that in Denmark, and at least twenty times that in Norway and Sweden. We compared the differences in death rate due to pneumonia, bronchitis and other respiratory diseases in our larger boroughs (over 100,000) and in our rural areas. The *difference* is about 42.5 per 100,000—that is to say some 425 per million. I quoted above the total annual rate of deaths from typhoid in the bad old days at 390 per million—that is to say less than just the *difference* for bronchial and lung deaths between town and country today.

And even our rural areas are far from being uncontaminated. My Committee found it necessary to establish priorities of action, and for that purpose concentrated on what we called the Black Areas—that is to say those areas where dense populations and heavy industrialization were found in spots naturally, for meteorological reasons, prone to bad fog. At least half the population of England lives in these black areas. But surveys have shown that the effects of air pollution, smoke and the finest dust, and still more the acidic sulphur dioxide, can be clearly traced 50 miles and more from its source.

I will not labour this further. I have in these brief comparisons taken no account of some of the other possible—or more than possible—lethal qualities of polluted air. We were bound to be cautious when we came to the dread word cancer, but we had to point out that there is a good deal of prima facie evidence for believing that air pollution may be a factor in cancer of the lung. We quoted too the evidence of the Registrar-General to the Royal Com-

mission on the Distribution of Industrial Population in 1938, giving smoke from factories and houses, by reducing the effective sunlight as one of the four factors in the unusually higher urban death rates.

Surely the case is proved. And this so far is only the toll of life. What of ill health? The toll of health is still greater—a consideration that could be virtually disregarded in counting the evils of polluted water. No one I believe can for a moment deny that in this grisly balance sheet to which I referred above, the scales are tipped heavily down on the side of air pollution. It is in fact a far worse, a far more widely spread, a far more insidious evil than impure water was—and one that persists through the year and through the years.

The Cost

But it would not perhaps have been worth labouring this matter, except for one point that I now want to make. Clean water and decent sanitation were achieved at great cost—and can only be maintained at great continuing cost. I doubt whether anyone has ever attempted to calculate what we have paid and are paying for our clean water and our sewerage systems. I have made some ineffective attempts to collect the necessary data; it was too vast a subject to cover in the time I had at my disposal. But let me give you a few figures. The capital cost of water schemes authorized in England and Wales in the four years ended March 1954 was just about £77 millions. At present-day values the capital invested in water supply undertakings and works and in distribution must be a long way over £2,000 million.

Then consider what every householder pays for his piped water. In the Metropolitan Water Board area it is 1s. 11½d. per £ of net annual value of his house. In a large number of towns it is considerably higher. I have one figure of 3s.

Let us turn to sewerage schemes. Here again the capital cost authorized in the four years ended March 1954 was nearly £78 millions. From the Annual Return issued by the Institute of Municipal Treasurers and Accountants, I find that in County and non-County Boroughs the proportion of the total rates devoted to sewerage and sewage disposal is just about 6 per cent.

My own company pays quite a few thousand pounds a year to the West Middlesex sewage works at Mogden for accepting and dealing with our waste effluent. Very glad we are to dispose of it so satisfactorily, with harm to no one; and very efficiently they deal with it. Now that scheme, established in the 30's, serves a population of about 1¼ million persons and has so far cost in capital rather over £4 per head. At present construction costs and money values that would mean at least £12 per head.

A few days ago there was an item of news in the *Times* which is apposite and which I will quote.

> "A High Court injunction granted two years ago to local angling societies restraining Derby Corporation from polluting the River Derwent will cost the town over £500,000 during the coming financial year. The money will be spent on the first large instalment of sewage works extensions, which in all will cost the corporation over £2m. A contribution towards part of the scheme will be made by British Celanese Ltd., who have a factory at Spondon."

All this is no exaggerated indication of what it has cost and is costing to have clean water and civilized sewage disposal. We all know that there is still a heavy programme of expenditure to be faced. We accept this burden as the price of health and decency. So *if* there should be any voice raised questioning whether we can afford now to have clean air, on the lines of our report, I would refer the critic to these figures I have quoted. And thereafter would I remind him that my committee's conservative estimate of the economic cost and loss to this country from polluted air was of the order of £250 million a year; and there is in addition

an amount of wasted and misused coal that we calculated meant possibly as much as 10 million tons of coal a year, or another £25 to £50 million.

May I just cap this by reminding you that while a man consumes something like 3 lbs. of food a day and 5 lbs. of water—or at any rate liquid—a day, he consumes at least 30 lbs. of air a day.

Gaseous Pollution

I said at the outset that I was assuming that the main principles of my Committee's report were in the near future going to be given legal form and put into operation. I also said that—a great step forward as I naturally think it would be—that in itself by no means solves the problem. It has been said by some disappointed enthusiasts that my Committee failed lamentably to deal with the really serious question, that of gaseous pollution of the air—and in particular with the sulphur. That is not fair to the authors of the Report nor wholly accurate. Both in the Interim Report and in the Final Report we attacked Sulphur Dioxide. We pointed out the clear correlation between the pollution of the air by smoke and sulphur dioxide and the daily death rate in the London Smog. Sulphur Dioxide we said, is one of the most harmful of all the polluting agents. We pointed to the vast damage to metals and building materials from the corrosive sulphur acids due to the sulphur in our fuels. We devoted $2\frac{1}{2}$ pages of our final report to Sulphur pollution; and we came down very definitely in favour of flue gas washing in large power stations, and this last should imply any other place where such large quantities of coal or oil are consumed.

But having said all this, and having pointed out that obviously the best means of preventing the sulphur pollution of the air that arises from our burning sulphur-bearing oil and coal, would be to remove the sulphur before combustion, yet we had to admit that at present we have no *complete* answer to offer.

We devoted a great deal of time and anxious thought to this; we heard a lot of views. What is abundantly clear is that there is insufficient information. As a committee we had no doubt whatever as to the soundness and practicability of the views we formed and the recommendations we made to deal with smoke, grit and ash. We saw that it was quite possible to create a country of smokeless zones and smoke-control areas. We therefore spoke clearly and emphatically and I think that the report's favourable reception may be attributed in some part to its uncompromising presentation. We could not alas—and no one can yet—take that same emphatic line in regard to the gaseous pollutants. But one only admits that, in order to emphasize how essential it is that we should know more about them—that we should know enough to enable us to deal with this other most serious aspect of air pollution.

There is I may say no evidence whatever that we saw to justify any doctor or other expert stating that the whole or the major danger of smog is the sulphur. So far as we could measure authoritative medical opinion, there was no doubt that the deleterious effects of the oxides of sulphur were greatly enhanced by the presence of smoke particles; and it was our conclusion that the *first objective* must be to prevent the emission of coal smoke and oil smoke. Equally there was no evidence at all as to the particular constituents, or the particular combinations of pollutants, that made the London Smog so peculiarly lethal. We are not alone in this experience. Efforts to impeach this or that chemical or element in the various types of smog to which American cities are prone, have so far wholly failed.

Now I say all this in no plea for mitigation of sentence on my Committee. My Committee did but record what was known, or rather what was not known. It is a criticism of the community that the efforts to tackle this acute problem have—at least as we saw it—been so feeble. We devoted a whole appendix to indicating what is required in the way of

research, and much of that is in regard to sulphur and the other gaseous pollutants. That research is vital. But it needs to be co-ordinated and directed as a whole. There is altogether quite a lot of experiment and investigation and research and the collecting of data going on; but it is sporadic and unconnected. The doctors and the chemists and the fuel technologists are all pursuing their own theories and objectives, taking no, or little, regard of each other. And extraordinarily conflicting statements are being made with all the seeming of scientific truths.

I did collect a number of unreconcilable statements that have been made by different students and experts and enthusiasts. But I have decided not to make use of them, at any rate here. It is not my desire to decry or depreciate the efforts of anyone who is working on this important and elusive problem. I would only say that results will be the much quicker obtained if we can infuse some order and cohesion into all these investigations. Moreover we must be clear what it is we are after.

Sulphur is not the only problem. The smog of Los Angeles does not owe its virulence to sulphur dioxide. The increase of motor vehicles, the increase of diesels, are going to make the problem more serious every year to us. We do not know very much about the exhausts of diesels and petrol motors. We do not know what it is in these exhausts that we particularly want to eliminate. We do not know what are the conditions in which concentrations can be dangerous or deleterious. These are things which must be studied.

And as regards sulphur, of course it is serious—very very serious. But we have no present method of dealing with it as a normal commercial operation. The British Electricity Authority has been very quick to point out that our flue gas washing proposals would add to the cost of electricity. They say, incidentally, 12 per cent.; our calculation was that it would be likely to be nearer 4 per cent. in any new stations. But the point that we did make—and which surely is very pertinent—is that while we are every year putting over 3 million tons of sulphur into the air, we are forced to import our sulphur requirements for industry; I would like to quote from our Report.

" We would point out that sulphur is an important raw material for industry, and that world supplies of sulphur for the future are by no means sure. There are possibilities (to put it no higher) that significant amounts of sulphur and saleable sulphur compounds could be recovered from coal-cleaning plants, from coke oven gas, from oil refinery gases, from producer gas and from the flue gases of very large fuel-burning installations. It would seem to us that expenditure on the removal of sulphur from the atmosphere, which would at the same time yield sulphur and saleable sulphur compounds from indigenous raw material might well be a profitable national investment, and that Government assistance towards the development of processes would be worth considering."

This too is one of the matters to which urgent attention should be given.

At this stage then, once we have seen the promised bill in operation, all our pressure should be switched on to this next stage in the campaign. This next stage—this need for research and for finding the answers to the many questions still outstanding—was a decisive factor in our conclusion that there should be established a permanent, active and authoritative body solely concerned with the clean air campaign. We called it the Clean Air Council. In our view it is an essential part of our solution. It seems to have altogether escaped notice in the Parliamentary Debate.

I hope that nothing that I have said will leave in anyone's mind the impression that I feel that the recommendations of my Committee were incomplete or inadequate. They would, we believe, if carried out give us again an England cleaner than it has been for a hundred years. But there is still more to be done.

Miss VIOLET C. ROBERTON

We record with profound regret the death of Miss Violet C. Roberton C.B.E., LL.D., on 3rd October, 1954, after a prolonged illness. Miss Roberton devoted her life to the public weal and gave thirty-three years unstinting service as a Councillor in her native city of Glasgow. Her interests were many and varied but the advancement of Public Health and Welfare held pride of place in her work for the community.

The aims and objects of this Society received her generous support and encouragement and she valued highly the recognition of her interest in accepting the office of Vice-President.

Miss Roberton had great charm and dignity, and her approach and manner in coping with human problems, large and small, were exemplary. Her voice was delightful to hear and her expressions sincere and animated. We shall miss her help and counsel in our assembly, and so too will many in all walks of life north of the Tweed.—J.I.

MR. ALEC LONGFELLOW

The Midlands Joint Advisory Council for the Abatement of Smoke and Atmospheric Pollution suffers a great loss in the death, on 13th January, 1955, of Mr. Alec Longfellow, recently retired from his post as Chief Sanitary Inspector to the Borough of Rowley Regis. A man of wide interests in his profession, he was an early pioneer in the cause of clean air in the industrial Midlands and his services as a member of the Executive Committee of the Advisory Council since its inception in 1928 have been such that, on his retirement, he was nominated for honorary membership of the Council.

Not only was he an ardent advocate of Clean Air in the Council Chamber and in Committee, but he practised what he preached; with his completely smokeless home he set an example to all his neighbours and to his colleagues.

He will be missed also at the Annual Conference of the Society, which he has attended with such enthusiasm for so many years. Widespread sympathy goes out to his wife who so faithfully supported him in all his efforts.

MR. P. H. SAUNDERS

It is reported with deep regret that Mr. Percival Harold Saunders died in Liverpool on January 31st, after a short illness. He was 52 years of age, and was appointed Chief Smoke Abatement Inspector to Liverpool Public Health Department in 1948.

He had hitherto been employed in local government as a Smoke Inspector in Birkenhead for over twelve years, and in the same capacity under the Sheffield, Rotherham and District Smoke Abatement Committee for three years. Prior to this he had a varied career as an inspecting engineer to South African Railways and Harbours, and as a draughtsman designer. He was originally an engineer with the London and North Eastern Railway for several years.

He held the qualifications of sanitary and food inspector, as well as smoke abatement inspector, and was Hon. Secretary to the local branch of the Institute of Fuel. He was also a member of the Liverpool Engineering Society and of the North Western Division of the National Smoke Abatement Society.

He was closely concerned with the Medical Officer of Health with the detailed preparation for the new smokeless zone in Liverpool, and had given many lectures on fuel economy and smoke abatement at the University School of Hygiene for the Sanitary Science Instruction Committee. He was an examiner in the subject for the Royal Sanitary Institute. Shortly before his death he was elected a Fellow of the Institute. His unfortunate death leaves a gap which will be extremely difficult to fill.

COAL AND SMOKELESS FUELS

Sir Charles Ellis, F.R.S., delivered a most interesting address to the Royal Institution on Friday, December 10th, on the above subject. It was illustrated by films and simple experiments.

Sir Charles said that although smokeless fuels such as " Phurnacite," " Coalite," gas coke and dry steam coal were being produced, far greater quantities of such fuels were needed for the home market, of a wider range. Although it would be possible to process more of the carbonization coals, the long-term supply position of these gave cause for considerable anxiety, and far from there being a surplus of such coal, there was in fact a deficit. It was important therefore to try to produce smokeless fuels from coals which would be in ample supply, especially the " fines " or powdered coal.

A process to which a great deal of attention was being given was the " fluidization " process. This enabled the collection of the volatile matter in a useful and saleable form, and permitted the design of a continuous process. The basis of the method was the blowing of superheated steam or a hot inert gas upwards through a column of coal dust. The fine char which remained had to be compacted, and to do this a binder was necessary. In one of the most promising processes, a stream of red hot sand was passed continuously over the briquettes. Such a process produced a briquette which was smokeless, but which would light with paper and wood and give a bright cheerful fire. There would also be considerable quantities of liquid fuels. The coal had been " taken to bits," and reconstituted in the form of briquettes of controlled volatility, and liquid fuel.

Bench experiments, and work on a small plant producing 50 lb./hr. had already been completed, and good progress was being made on the next stage—production of 1 ton an hour, but it would be some time before it was possible to establish a pilot manufacturing plant.

Another interesting discovery at the Coal Research Establishment was that the high volatile coals could be compacted without using any binder at all. The resulting briquette was strong and clean, could be carbonized, and the volatile matter driven off. Although there were great difficulties ahead, this new process might be of great help in the future, and alleviate our lump coal shortage.



One of the tankers delivering metered domestic fuel oil, as mentioned in the note on page 131

Air Pollution from Road Vehicles

A Statement made to a recent meeting of the Society's Technical Committee by

Dr. A. FITTON

Fuel Research Station, D. S. I. R.

IF we consider vehicles driven by petrol engines and diesel engines, we shall find that the composition of the exhaust gases differ considerably for the two types.

From the point of view of air pollution, one important constituent is carbon monoxide. From the petrol vehicle, the exhaust gas may contain proportions varying from little more than zero to 12 or 13 per cent.—a great deal too much to discharge into the atmosphere. From the diesel engine, running under practical conditions, the exhaust gas does not usually contain more than about 1 per cent. of carbon monoxide. To give average values of the above proportions would be misleading, but if I might quote typical values, we could probably say 4 per cent. of carbon monoxide from the petrol engine and 0.05 per cent. from the diesel engine.

Carbon dioxide, which does not trouble us very much, occurs to the extent of about 9 or 10 per cent. in the exhaust from both types of engine.

The hydrocarbons comprise the next category. As much as 4 per cent. of the exhaust gas from a petrol engine may consist of methane and higher hydrocarbons, both saturated and unsaturated. In Los Angeles it is stated that the total losses of hydrocarbons from the use of petrol, including all losses from evaporation at filling stations, petrol tanks, carburettors, etc., is 7 per cent. The value for the diesel engine is much smaller, the maximum percentage amounting only to about 1.5, but in the normal way it is of the order of about 0.2 per cent.

We next come to the unpleasant constituents of vehicle exhaust gases—the aldehydes. We have, for many years, thought that the diesel engine was the main offender, while the petrol engines emitted relatively small amounts of aldehydes. However, more recent work in America, particularly in the Los Angeles area, on modern and semi-modern petrol driven cars clearly indicates that in spite of improvements in engine design, an appreciable amount of aldehydes is discharged into the air. The percentage is relatively small, up to 0.014 for petrol and up to 0.01 for diesel engines, but it is noticeable at concentrations of 0.0001 per cent.

Next come the oxides of nitrogen. These also present a complex problem and it is difficult to determine how best to express the oxides of nitrogen since they can appear in different forms. If they are expressed in the form of NO_2, however the discharge from the petrol engine may be as high as 0.25 per cent., i.e., 2,500 parts per million. The maximum for diesel engines appears to be of the same order as with petrol—that is 0.15 as against 0.25. The typical values are closer still, being about 0.04 for diesel engines and 0.05 for petrol engines.

Finally, there is the sulphur dioxide. In the petrol engine, the SO_2 in the exhaust gas is negligible since petrol is sensibly free of sulphur. The exhaust from a diesel engine, however, when operating on a fuel of sulphur content of 0.5 to 1 per cent., may have somewhere in the region of 0.02 per cent. SO_2 in the exhaust gases.

Toxic Limits

Now for the toxic limits of these pollutants. If there is a concentration of carbon monoxide of more than

0.01 per cent. (100 parts to the million), it becomes rather difficult for a human being to exist in comfort and carry on his work for long periods. Heavier concentrations cause headache and sickness. The threshold for the oxides of nitrogen is 0.0025 per cent., or 25 parts per million. The aldehyde threshold seems to vary with the research group. Aldehydes can sometimes be smelt at concentrations as low as 0.5 parts per million, but the threshold at which it becomes intolerable, causing eye discomfort, seems to vary between 1 and 10 parts per million. The latest value quoted in America is 5 parts per million.

The foregoing gives a rough idea of the pollutants discharged into the atmosphere, which cause discomfort and trouble.

In Los Angeles the problem is quite different from the one we have in London. In Los Angeles there is no atmospheric pollution due to the burning of coal, and every investigation carried out indicates that it is the hydrocarbons, the oxides of nitrogen, and the ozone formed by their consequent reaction with sunlight, which together form the type of smog peculiar to Los Angeles. That is why they are much more concerned with automobile exhaust gases than we have been in this country in the past.

The estimated value of CO discharged by domestic fires in London is three times the amount discharged by all the vehicles operating in the London area. Although the discharge takes place at different heights, in some atmospheric conditions the domestic discharge comes down to ground level. A form of scale of thresholds for exposure to CO has been published, but a man working eight hours a day would be in trouble in a concentration greater than 100 parts per million. For shorter periods, a concentration of 30 times greater would be tolerable, while for five minutes it would be tolerable in a concentration 100 times greater.

Flue gases from chimneys generally rise vertically whereas exhaust gases from vehicles are discharged just above ground level and have less chance of dispersal before being breathed by the public.

The Los Angeles basin covers about 4,000 square miles, and what is considered to be a " high wind " is something like 5 miles an hour! At about 1,000 feet an inversion layer occurs, and starting from about 8 a.m., the ozone content of the atmosphere rises from about 0.05 part per million to up to 0.8 part per million just after lunch (i.e., when the traffic has reached its worst). During the afternoon it tends to decline. This happens throughout the summer, when there is little rain, wind, or tempest—just sunshine and smog!

Although in the past the oil refineries created a serious nuisance, they have been cleaned up so much in the last five years that they have ceased to be a major problem. From the burning of natural gas, fuel oil and the combustion of petrol, 1,452 tons per day of hydrocarbons are discharged. The petroleum refining industry is responsible for only 150 tons per day. A great deal of work has been done in the refinery on the recovery of sulphur, and as a result sulphur is now a much less serious problem.

In the past, atmospheric samples have been taken and analysed for CO content, because this is one of the most straightforward means of assessing atmospheric pollution from exhaust gases. These analyses showed that in traffic areas the CO concentration is 10 to 20 times that found in areas with little traffic. A similar situation occurs in badly ventilated garages, and the degree of pollution is a good test of the adequacy of ventilation. Again, in the Blackwall Tunnel, during a traffic jam, the CO content rises to something like 20 times normal.

In passing, the problem of pollution by additives in diesel oils, petrol, and lubricating oils is relatively small when compared with hydrocarbons. Various solutions to the problem are being investigated. There are three main lines of approach.

1. There is a steady improvement in

combustion chamber design. A curve of CO content in the exhaust gas shows a steady decline when plotted against time over the last 20 years. A consequence of improved design is the increase in the compression ratio, with a resultant increase in efficiency.

2. An improvement in fuels is possible. It is now practicable to use higher octane fuels than before.

3. There are some miscellaneous methods of disposing of the impurities.

(*a*) Attempts have been made to recycle the flue gases. The method has little to recommend it.

(*b*) A newer technique provides for " after-burners." These are combustion chambers where the exhaust gases are burnt. Since some form of ignition is necessary in the chamber, it seems to be a rather unsatisfactory method. Moreover, the approach is negative rather than constructive.

(*c*) A more promising line of development is the oxy-catalyst technique, about which there is, unfortunately, little information. The method consists of passing the exhaust gases through an oxy-catalyst chamber containing porcelain rods, which are coated with an alloy of alumina and platinum. They need to operate at a temperature of 500-550° F. It has been claimed that 90 per cent. of the CO content is removed, but this is a higher figure than has been obtained in tests carried out in France. It is not known how long they will operate efficiently, how long they will resist lead poisoning, nor is their performance on a diesel engine known.

(*d*) A recent paper published by the Institution of Mechanical Engineers throws new light on one aspect of the problem. It is titled: " The Effect of Auxiliary Fuels on the Smoke-Limited Power Output of Diesel Engines." The writers cut down the diesel oil content of the fuel to 80 per cent., and made up the other 20 per cent. with aspirated petrol. They show that more power than normal can be obtained for the same limitation of smoke in the exhaust gas.

A few scattered comments:

1. When comparing diesel and petrol engines, it must be remembered that while the average figures for pollution are lower for the diesel than for the petrol engine, the diesel also tends to discharge far more carbon or soot than the petrol engine.

2. Whilst the condition of the engine and vehicle is of some importance, recent American research shows that, comparing 1940-42 cars with 1950-51 cars, there is no appreciable difference in the hydrocarbon discharge during acceleration and cruising. When the engine is idling or decelerating, however, there is a considerably higher hydrocarbon discharge from the older car.

3. The average figures for CO content for 4 modern American cars, petrol driven were:

Accelerating	..	4.7 per cent.
Cruising	..	3.0 ,,
Decelerating	..	2.7 ,,
Idling ..	..	5.7 ,,



A newcomer in the field of the open fire with back boiler is the Ideal No. 10 *Neofire. Using a* 30 *gallon direct cylinder it can satisfy all the domestic needs of the usual modern house, effectively using* 60 *per cent. of the generated heat from* 2 *lbs. or so of smokeless fuel an hour*

The B.E.A. on Flue Gas Washing

The British Electricity Authority have issued the following statement on the Beaver Committee's proposal that flue gas washing should be introduced at all new power stations:

" Gas washing has a long history and has been actively explored by all parties including the Government, the Electricity Supply Industry and the public health interests. Despite the Beaver Committee's views, it is by no means established that gas washing can be effectively introduced. Moreover, the Committee themselves recognize that the complete removal of sulphur dioxide from power stations would leave more than three quarters of the sulphur problem unsolved. Certain technical considerations are discussed in their Report, but there are many complicated features which the Government and the Authority will have to take into account in reaching their decisions. Whilst some of the references in the Report are ambiguous, the Authority are submitting to the Government the relevant factors, including the heavy capital cost which, covering also further grit arresting installations, could not be less than £140 m., and might even reach £250 m., within the next ten years. This, together with the extra operating costs, would involve an increase of at least 12 per cent. in the generation cost of electricity.

" Notwithstanding these considerations, the Authority are prepared to face the financial liability incurred in installing gas washing plant at power stations when they are satisfied, after consultation with the Government, that this is the right course to pursue on grounds of national interest and public health. Whatever the Government's decisions may be, the Authority will loyally and energetically seek to implement them."

The Ministry of Health Report on the London Smog

To the Editor,
" Smokeless Air."

Sir—I was interested in your Medical Correspondent's careful comment on this report. To my mind it is the weakest effort from the Ministry I have ever seen. The expert committee has failed to grasp the " nettle danger " —still less have they plucked the " flower of safety " from their consideration of the London smog. To dismiss the effect of the smog on " the great majority of normal healthy " people as " little more than a nuisance" is a gross understatement by which this unhelpful report alone stands condemned—that was just not true.

Other comments one could make include the point that the coroners' pathologists did not give (nor could they be expected to give) the expert and specialized help which is necessary in these incidents; to conduct a post-mortem on these subjects requires highly skilled pathology, and the resources of a department such as is found in a teaching hospital. How then can one have confidence in the results of the post-mortems?

The maps given in figures 1 and 2 give a very rough idea of where the mortality occurred. It should be possible to link up the place where the people who died had lived and/or worked with the degree of pollution. Something very more exact than shaded areas in Borough boundaries is required for this. How did this report pass the critical minds of those in charge of the Ministry of Health?

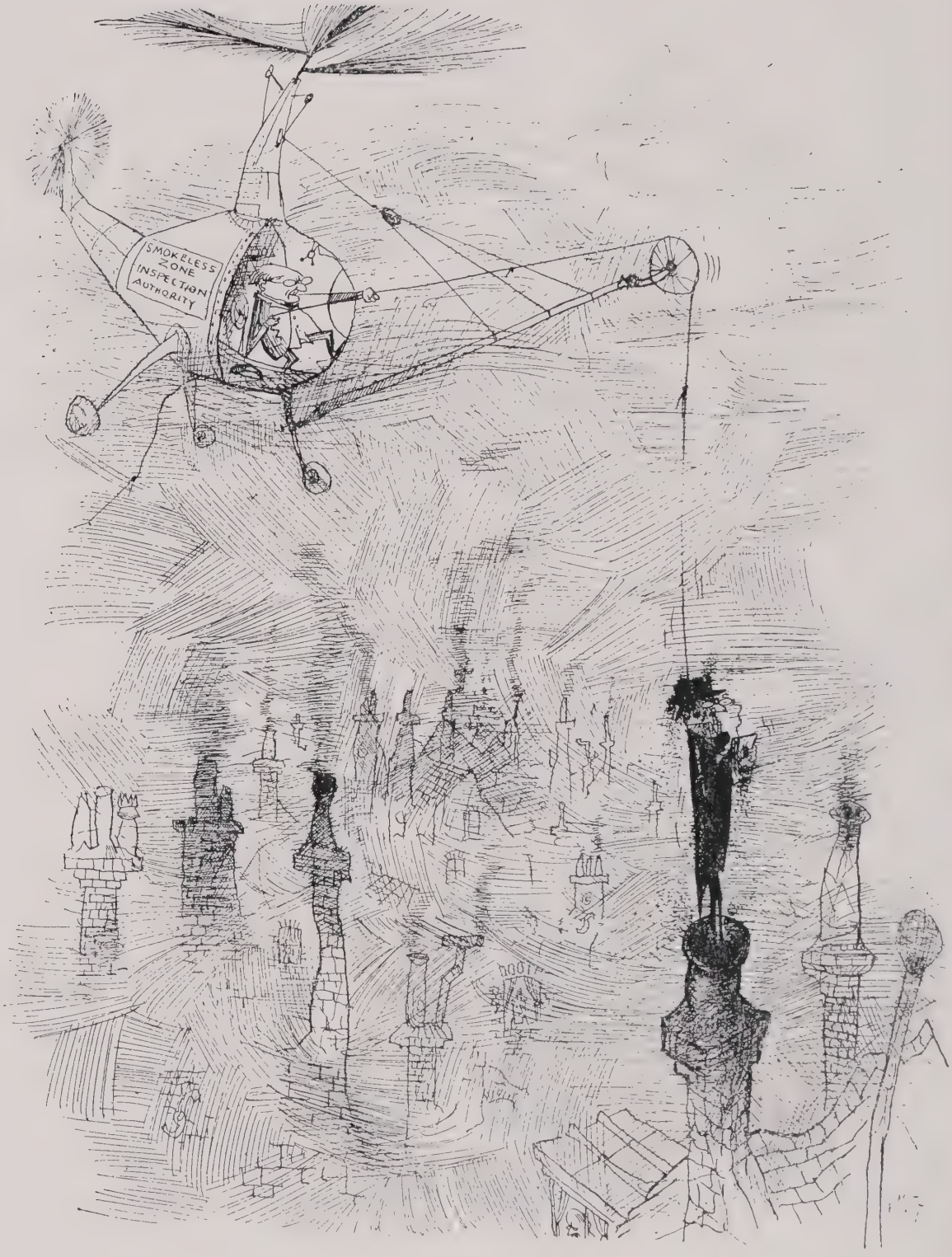
There are also a number of minor omissions—for instance in the veterinary report it does not state the differential mortality amongst the animals—the fat stock on the ground floor and the sheep, etc., on the first floor.

I agree with your correspondent that the report is written in the language of restraint—the restraint, however, is of such a degree as to render the report feeble.

Yours, etc.,

M.O.H.

As Emett Sees It



" *Definitely not smokeless fuel . . .*"

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THE CLEAN AIR BILL DEBATE

House of Commons, 4th February, 1955

MR. NABARRO opened the debate by moving that the Bill be now read a second time. He opened his speech with an historical survey of the problem and continued by discussing the relationship between the country's fuel problem and air pollution. He then discussed the Bill, as follows:

I turn to the Bill and deal first with an exclusion—a specific exclusion—the smoke from railway engines. Sir Hugh Beaver recognized in his Report, Recommendation 5 on page 34, that there should be legislation in connection with railway engine smoke. That I regard as quite impracticable. It was tried in 1845 and again in 1868. In fact, railway engines cannot be made to consume their own smoke. What we are doing in the form of the £1,240 million modernization and re-equipment programme of British Railways—a cardinal feature of that programme is the large scale electrification, including diesel tractive equipment—will lead to the abatement of smoke. I congratulate Sir Brian Robertson, Chairman of the British Transport Commission, for stating on behalf of the Commission—this is the first nationalized industry to do so—that it is the policy of the industry to embrace and support the recommendations of the Beaver Committee. Sir Brian said, in introducing his modernization and re-equipment scheme two weeks ago:

"The Commission are very well aware that they are responsible for a share, not as much as is generally believed but still a share, of that unpleasant phenomenon known as Smog. They receive complaints from time to time from people who live close to their lines and they often find it very difficult to answer those complaints. Conversion to electric and diesel traction is the only effective way in which British Railways can relieve themselves of their responsibility for this nuisance."

I am sure every hon. Member will wish to join with me in congratulating Sir Brian on his commendable alacrity in responding to the recommendations of the Beaver Report.

The Bill before the House today is Beaver, nearly the whole of Beaver, and practically nothing but Beaver. If hon. Members turn to the Bill and the Beaver Report, they will find this connection between the provisions of the Bill and the recommendations of the Committee. Clause 1 of the Bill is strictly permissive in character. It affects local authorities and is recommended by the Beaver Committee in recommendation 6 (1), smokeless zones, on page 34. Clause 2 of the Bill—(Smoke control areas)—follows Recommendation 6 (2) of the Report. Clause 3, dealing with smoke from industrial furnaces, is Recommendation 4 of the Report. Clause 4—(Grit-arresting plant in certain furnaces)—is Recommendation 2 of the Report.

Clause 5—(Dark smoke from chimneys of manufacturing or trade premises)—is the total prohibition of dark smoke after a given date and relates to Recommendation 1 of the Committee. Clause 6—(Scheduled works and processes)—is Recommendation 3, suitably amended to allow the large and major local authorities to have total autonomy in the matter of controlling emission of smoke, fumes, grit and associated matter from all establishments within their respective areas, subject to Ministerial declaration.

Clause 7 (1) and Clause 7 (2), dealing with the duties of local authorities, are, respectively, Recommendations 10 and 11 of the Report, and Recommendation 12, calling for increased penalties, is embodied in Clauses 1, 2, 3, 4, 5 and 6 of the Bill. If hon. Members seek precedents for what is written in the Bill, I may tell them that the drafting follows very largely model Clauses and also Sections already contained in a large number of local Acts of Parliament, already appertaining to various parts of the country. Therefore, in one respect the Bill before the House might almost be considered a consolidating Measure, because it would bring within the ambit of general legislation what already exists in so much local legislation, but of course, would relieve local authorities in future, from the heavy expense of obtaining a special local Act of Parliament in order to be able to create smokeless zones or smoke control areas within the respective areas of the authorities concerned.

I have been criticized for omitting four recommendations of the Beaver Committee. I wish now to tell the House why, for there is a powerful reason in every case. Recommendation 5, dealing with railway engines and colliery spoilbanks, is a question very largely within the existing powers of Ministers under the

nationalization statutes. It would, therefore, be inappropriate to seek additional legislative powers on those points. Recommendation 7 is very largely within the ambit of existing Exchequer grant facilities. I see the hon. Member for Brightside (Mr. R. E. Winterbottom) opposite. He has spoken to me about the controversial issue of whether it should be the Exchequer that carries the whole cost of providing replacement of domestic grates or whether such expenditure should be partly rate-borne. That is a matter which may be argued later. I do make provision in this Bill for a Money Resolution following. It is therefore open, if the Bill receives a Second Reading today, to deal with this financial matter at a later stage.

Recommendation 8, on the determination of minimum standards for domestic appliances is, I believe, within the existing powers of Ministers. Recommendation 9, calling for a variation in Purchase Tax rates, is clearly not a matter for legislation, for the Chancellor only recently, in his famous " Mink and mops " Orders, was responsible for varying Purchase Tax rates without seeking new legislation.

For those reasons, I say that nearly the whole of what is legislatively practicable and possible is embodied in the Bill before the House. Much has been said in the public Press and elsewhere about the cost of carrying through a clean air policy. It has been said on many occasions that large sums of public or Exchequer moneys are required. That is quite wrong. A few simple explanations may suffice to answer that point.

Three groups of interests are broadly concerned with a clean air policy—the nationalized industries, the whole of private industry and commercial premises, and residential property, whether owner-occupied or on a tenanted basis. Nationalized industries have complete financial autonomy, subject only to granting of permission for raising overall sums of capital by the Minister of Fuel and Power and subject to Treasury guarantee given from time to time by the Chancellor of the Exchequer.

So far as private industry is concerned, I dispute at once that private industry needs a subsidy for re-equipment to abate smoke from its chimneys. I do not think —let me say this slowly and very deliberately—in any circumstances that a subsidy should be granted by Parliament to private bodies and private interests for doing those things which in their own interests and in the national interest they should do without monetary incentive.

During the passage of the last Finance Bill, on an Amendment introduced by the hon. Member for Gloucestershire, South (Mr. Crosland), we debated the loan scheme for industrial fuel efficiency. If hon. Members would take the trouble to refer to the speech which I made on the Report stage of that Bill, they would find a complete exposition of the fact that it costs an industrial firm nothing to go to the Government for a loan to replace equipment for fuel efficiency and, therefore, for smoke abatement purposes. I do not see that we need have an additional subsidy.

I have not consulted the Federation of British Industries; I have no intention of doing so. The Federation may have its own views on this subject. I shall continue to argue that industry must finance itself in this matter, and in any event fuel conservation——

The Minister of Fuel and Power (Mr. Geoffrey Lloyd) *indicated assent.*

Mr. Nabarro: —as my right hon. Friend nods his agreement at once—must be a profitable investment. Why should industry not invest in something that will bring it handsome dividends? If any individual firm cannot afford the initial finance, that firm can go to the Government for a loan on very generous terms.

There remains only the question of residential property. There is provision in Clause 1 (2) and 1 (3) for local authorities financially to assist householders to replace grates. Certain replacements may be carried out by owner-occupiers under Schedule A maintenance claims and a good deal of the cost recovered. The Exchequer grant to local authorities may be manipulated so as to reimburse local authorities with a substantial part of the cost involved. Under Clause 11 of the Bill we can, if necessary, consider at a later stage whether any direct subsidy should be brought in.

I have only one further matter shortly to deal with: namely, sulphur pollution of the atmosphere. Many people think that any attempt to abate smoke is valueless unless one deals with the parallel problem of the emission of sulphur fumes from chimneys of all descriptions. One cannot burn coal, coke or fuel oil without emitting sulphur in the form of sulphur dioxide and, to a lesser extent, sulphur trioxide. A certain amount of these substances is retained in the ashes but

most of the sulphur gases go up the chimneys into the atmosphere. There is no known method of removing these sulphur gases except in the case of large establishments such as power stations, and even there the cost is very high for the equipment.

Sir Hugh Beaver says, in paragraph 56 of the Report, that even if all the power stations washed their flue gases and recovered the sulphur from the fumes, still 75 per cent. of the sulphur problem would remain untouched. Sir Hugh Beaver says furthermore that a great deal more scientific attention is required to this problem in an effort to find practicable means of removing sulphur from flue gases in the case of both industrial and domestic establishments, and particularly blocks of flats, but it depends on scientific progress whether that desirable end can be reached within a measurable length of time.

There has been a good deal of criticism as to whether smokeless fuel supply could support a policy of the kind that is embodied in the Bill. My reply to that criticism is very short. Hon. Members should read Appendix XI of the Beaver Report, contributed by Dr. Foxwell, a past President of the Institute of Fuel, in which he sets out the position with very great accuracy.

No doubt, if the House of Commons legislatively embraces a clean air policy, the policies of the principally concerned nationalized industries—namely, the National Coal Board and the gas boards—would suitably be reorientated to provide for an adequate supply of smokeless fuels such as coke and anthracite and of such proprietary commercial fuels as " Phurnacite," " Rexco," " Coalite," and so on, to furnish in total, a suitable supply, for domestic needs.

The crux of the problem is that, Sir Hugh Beaver rightly observed, we can reduce 80 per cent. of the smoke-pollution in the black areas of the country within 10 to 15 years. To do that means replacing only—I use the word relatively—19 million tons of raw bituminous coal burned in domestic establishments by an approximately equivalent quantity of smokeless fuel in any or all of the types I have mentioned.

My right hon. Friend the Minister of Fuel and Power nodded his agreement when I enunciated my views on the progress of smokeless fuel production at a rate commensurate to the introduction of additional smokeless zones envisaged under the Bill. It is a question of the co-ordination of the national policy of my right hon. Friend, of nationalized industries and local authorities, all of which is perfectly possible and practicable.

I said at the outset that my backers and I, in connection with the Bill, mean business. We mean business this day. In the event of Her Majesty's Government being able to give an assurance that they will introduce, during this Parliamentary Session—I repeat, this Parliamentary Session—a comprehensive Measure, including all necessary financial provision, to give full effect to a policy of clean air on the general lines recommended by the Beaver Committee, my colleagues and I who are associated with the Bill would be prepared, after a full debate today, to seek the permission of the House to withdraw my Bill. I have referred to the Government introducing a Bill because I realize that the question of whether such a Bill could be taken through all its stages would depend upon the exigencies of Parliamentary time. In the event of the Government giving the assurance which my backers and I seek in this connection, we would do our utmost to facilitate the passage of such a Measure, this Session.

I repeat that if the Government give an assurance in the terms I have indicated, then, and only then, will we be prepared to withdraw the Bill today. In other words, one way or the other we propose legislatively to embrace, this Session, a clean air policy. Whether the Government do it with their own comprehensive Measure or whether we do it with the Bill that we place before the House today, suitably amended during the later stages, is not a matter of great personal concern to me. All I am interested in is that there shall be a clean air policy for this nation and that appropriate legislation shall be placed on the Statute Book, in the form of a Clean Air Act, before the end of the present Parliamentary Session.

Following are extracts from the other speeches, with the statements by the Minister of Housing and Local Government and by Mr. Philip Noel-Baker recorded in full. Dr. Barnett Stross and Mr. Ellis Smith were moving that the Bill be read " upon this day six months."

Mr. Alfred Robens (Blyth): I do not think we should confine our appreciation and thanks to the members of the Beaver Committee and Sir Hugh Beaver, although I do thank them most warmly. We must remember that through the years there

has been a procession of committees, such as the Ridley and Egerton Committees and others, and organizations like the Smoke Abatement Society, all trying to do a first-class job of work. There have also been individuals. I will not mention them, since they are so numerous and it would be invidious to select one or two, although their names come readily to my mind. Large numbers of people have spent their private money in research into all sorts of ways of producing better smokeless fuels.

It is a great tragedy that year after year coal is produced at the cost of human life and because the deaths which occur are isolated cases throughout the mining areas they receive no public comments at all. If there were a pit disaster every year in which 480 men were killed, I do not know what public opinion would say about it but I do not think that it would be possible for an industry to stand up to a disaster every year which at one fell swoop robbed 480 men of their lives.

Yet, since the war that is precisely what has been happening in coalmining, but because one is killed here and one or two there and the fatalities are spread over a wide area and are isolated they receive no real publicity. Although the public often complain of the price that they pay for coal, I am afraid that they do not realize the enormous cost of coal in human life, and the suffering, anxiety and sorrow that coal production unfortunately brings about. No one can represent a mining area or live in a mining village or have close contact with the mining community and not come across many cases where the bread winner has died early in life through a pit accident. For the rest of their lives the cost of coal bears very heavily upon the widow and her family.

In those circumstances, it is criminal that we should waste coal which has cost so much to produce. I hope that the Government will introduce a comprehensive Measure and, indeed, make it a criminal offence to waste coal in such a way. We have no right to accept such a terrible loss of life. Added to that loss are the tens of thousands of men in South Wales and elsewhere who are suffering from pneumoconiosis and will never be able to work again. We have no right to expect that coal should not be used properly. It should be made a criminal offence for it to be used wastefully and we must provide the means by which it will be no longer necessary for it to be wasted as it is wasted today.

Dr. Barnett Stross (Stoke-on-Trent, Central): My criticism of the Bill falls into two main parts. In the first place, as I have indicated, it is not comprehensive enough. That is due, in part, to the fact that it is a private Measure, and, as the hon. Member for Kidderminster has pointed out to the House he has felt it necessary to leave out certain legislative recommendations put forward by the Beaver Committee. They fall roughly into the two parts, which he described and which I will not dilate upon—the fiscal changes which are involved and the powers of direction exercisable by Ministers under the nationalization statutes.

It is my personal opinion—and I know that most right hon. and hon. Members will agree with me—that if we are ultimately to succeed we shall need all the influence and all the energy of any Government which is in power. Assuming that we give ourselves 10 years to achieve an 80 per cent. reduction of pollution of the atmosphere, it means that there is no time for delay; it means that no half measures can be tolerated; and it means that the country must be made to understand that it is a paying proposition.

The second part of my criticism of this Bill is that there is nothing which would protect the farmers from the increasing toll that flouride contamination is taking of their cattle, nor, indeed, does the Bill directly take into account the effects of sulphur gas upon human health. The hon. Member for Kidderminster referred to agriculture and to sulphur and I am very glad he did. He put questions to the Minister asking him to take note of what is happening in agriculture and if he would consult with the N.F.U. and the National Union of Agricultural Workers because of the serious effect of this pollution on the growth of crops.

Mr. Ellis Smith (Stoke-on-Trent, South): We consider that the time has arrived when the Government and local authorities should have compulsory powers. No longer are we satisfied with what was contained in the Minister's statement, that the Federation of British Industries and other people will consider taking voluntary action. The days for voluntary action on this issue have gone. It is compulsory powers that the Government ought to have, and it is compulsory powers for which we and other enlightened people throughout the country who are acquainted with the facts and have seen the evidence in their localities are asking today. Any Bill, no matter

from what quarter it may come, which does not contain within it resolute action based upon compulsory powers will receive our opposition.

Mr. Angus Maude (Ealing, South): The Bill has been criticized in some quarters on the ground that it would not merely involve administrative difficulties but would constitute a new and unjustified interference with the private rights of the citizen. I do not believe that this is either a true or a justifiable contention in this instance. Of course, the Government must take great care when framing legislation of this kind, but the whole history of social reform in this country proves that there is no reason why the Government should not decide that something is an unmitigated evil and simply prohibit it from being done.

The law says that nobody shall commit murder, but it does not go into immense detail to say how one is to prevent oneself from committing a murder. It simply says that murder shall not be committed and leaves the public to obey. I believe that that is very largely the principle which should underline legislation in this respect. It can be extremely dangerous and tend to stultify the success of a Measure if one goes into too great detail in legislation, and in regulations and orders, to say how a law of this kind shall be enforced.

For example, in a block of perhaps a hundred flats, one chimney might emit dark smoke and one would see people clambering up and down stairs to try to find from which flat the smoke was coming. That would be an intolerable situation, and it is not really necessary. The thing can be done much more simply than that.

Mrs. Freda Corbet (Peckham): We should get on with this job, because we are now wasting our resources and incurring needless expense. We could lighten the burden of the housewife and cut out much of the washing and cleaning that goes on, not only in the home but in offices and factories, in which there are enormous cleaning bills.

I want the housewife to be aware of these things. Even if she goes to Brighton she will be able to keep her hands and fingernails clean for more than an hour at a time, while if she goes to Geneva in the summer she will find she can go for a week without having to change her handkerchief. The fingering of handkerchiefs renders them dirty and unusable almost at once here. In countries like Switzerland snowy washing can be produced without the use of " Persil," soda or the latest detergents and bleaches, yet it will compare with anything that the best British housewife can produce in an industrial city. Black dirt and smoke discolour our washing.

Mr. Michael Higgs (Bromsgrove): I am one of those who feel that there is a good deal to be said against action in the form which this Bill proposes. Since I have already, in the last 12 months, been accused of being associated with the " dirty food lobby," and since I do not want also to run the risk of being associated with the " dirty air lobby," I want to make it clear to the House at the outset that, although I am opposed to the Bill, I recognize that a problem exists and that some action upon it should be taken.

I am one who has a great liking for a pleasant, open coal fire on a Sunday afternoon or evening. That is a bias which I confess, and I imagine that I speak for a number of menfolk, at any rate, when I confess it.

Moreover, I have an instinctive reaction against a Bill which invades people's houses and, as the hon. Lady says, in the areas where it is enforced, condemns them to either a gas or electric fire or to the burning of non-existent smokeless fuel. Because I have an instinctive reaction against such a Bill, *prima facie* I regard it as bad, and I ask whether there is anything to overcome my *prima facie* objection to it.

Perhaps I may give a couple of examples. In the section which deals with the effect of atmospheric pollution upon health, a conclusion is drawn that pollution has a considerable effect in causing bronchial diseases, pneumonia and similar diseases. When we study it, we find the main fact which leads to that conclusion is that more people who live in towns suffer or die from those diseases than people who live in the country. It is a very big jump from that fact to the conclusion.

I am also naughty enough to view with suspicion the calculations made about the economic causes of the various evils at which we aim legislation in these days. I suspect that if we added together the cost which it is calculated the country suffers every year in loss of assets from smoke pollution, the loss it suffers from the common cold and from traffic accidents and delays, we would find that we had lost more wealth than we had

ever had to lose. I view these calculations always with the gravest suspicion. Sometimes, also, as a sort of by-product of the same thought, when I hear a discussion of this kind following a discussion on road accidents and road safety and, perhaps, of the common cold, I come to the conclusion that this race is a race of headlong suicidal maniacs.

Mr. R. E. Winterbottom (Sheffield, Brightside): In congratulating the hon. Member for Kidderminster on what he has done to bring the Government to a realization of the situation, I want to add that the municipal corporations have also contributed a great deal in that direction. I know that the Minister has seen representatives of municipal corporations during the last fortnight and that they have pressed upon him what I feel most hon. Members are pressing upon him today. It is that he should accept the principle that the Government will introduce a Bill during this Session to give effect to the recommendations of the Beaver Committee. If the Minister will accept that, there are one or two suggestions which I should like to make to him.

The first is that in connection with the introduction of a Bill he should consult representatives of the municipal corporations, and especially the representatives of those corporations which have to deal with the difficulties caused by sulphur, grit, red shale and things of that kind. He should take their advice on how far he should give powers to local authorities to deal with those difficulties.

Secondly, it would be utterly unfair to saddle a corporation like the Sheffield City Corporation with the responsibility of meeting the financial burden involved in dealing with the problem. It might amount to many shillings in the rate per £ in a city whilst people who live in places like Bournemouth, Eastbourne and Bromsgrove get away with it for nothing. After all, it is the important industrial centres which make it possible within the economy of the country for the hon. Member for Bromsgrove to enjoy his Sunday afternoon by the fire and the evening walk in clean air to take away the effect of the time spent by the fireside.

Mr. J. Enoch Powell (Wolverhampton, South-West): This is the first time I think that I have found myself in direct disagreement with the hon. Member for Bromsgrove (Mr. Higgs). Unlike him, I believe that the method which this Bill adopts is in the line and tradition of our most successful public health legislation and of those successive great Measures which have dealt with the working and living conditions of our people over the last 100 or 120 years. Those Measures applied just the methods which this Bill seeks to apply; namely that when a definite evil is ascertained, to the continuance of which public opinion is strongly adverse, then, as soon as avoidance and prevention become practicable, that evil is defined and a prohibition imposed upon it by legislation.

After that prohibition has been imposed, it is, as my hon. Friend the Member for Ealing, South (Mr. Maude) said, for the public and the economy to adapt themselves to the new situation created. Incidentally, I believe that the indirect reactions over the whole field of fuel and power and over the economy generally as a result of this, or an equivalent Measure, will be far-reaching. But it is not the business of Parliament to approach these matters by seeking to control the individual methods adopted for the prevention or diminution of an evil. Parliament's duty is to define the evil, and, if avoidance by one method or another is practicable, then to prohibit it.

Mr. A. Blenkinsop (Newcastle-upon-Tyne, East): I am anxious that no hope of added subsidy or financial assistance to householders and others shall delay the immediate action which householders and others could be encouraged to take. The suggestion that in a few years' time some financial encouragement could be given might only delay what we want done. Therefore it is important to make it clear that, under existing powers, a good deal can be done from the financial aspect. I am thinking of the improved grants that can be made available under the 1949 Housing Act as amended by recent legislation. In many cases the necessary alterations to grates and to heating systems should be part of the improvement of property which we all want to see carried out and for which grants are already available. So there is no reason why that part of the work should not go ahead.

The Minister of Housing and Local Government (Mr. Duncan Sandys): This, I think, is one of the best debates that I have attended in the House for a long time. It has been interesting and extremely instructive. I do not think that anybody who has listened to it could fail to have been impressed by the wide knowledge of those who have taken part

and the deep sincerity with which they have approached the problem.

I should like, in particular, to thank and congratulate my hon. Friend the Member for Kidderminster (Mr. Nabarro), to whom we all owe the debate. I congratulate him upon his initiative in the whole matter, and I also congratulate him, as other hon. Members have done, on his most admirable speech, which contained historical allusions which, I am sure, delighted the whole House and also showed the profound nature of the research and technical studies which he has made and the time and effort which he has evidently devoted, not just now but over many years, to the whole problem. It was a stroke of good fortune that he drew the lucky number in the Ballot, good fortune not only for him but also for the House.

Let me say straight away that if my hon. Friend has been pushing us along a little, nobody resents it less than I do. There is, I am sure—it is not necessary to say so—no difference of opinion—at least, I have not heard of any yet—in this House and very little outside about the desirability of preventing, as far as possible, the pollution of our atmosphere. There is also, I believe, very little difference of opinion about the fact that it is already high time that we adopted the positive measures which are necessary to achieve that end.

As my hon. Friend the Member for Ealing, South (Mr. Maude) said earlier in the debate, it was precisely because the Government were impressed by the importance and the urgency of the question that in 1953 they appointed the Committee of Inquiry under the chairmanship of Sir Hugh Beaver. I should not like this opportunity to pass without paying my tribute also to Sir Hugh. I had the privilege and pleasure of working with him at the Ministry of Works in the latter part of the war. As one or two hon. Members have said, he has added a fresh page to his record of public service, one for which the whole nation is indebted to him.

As I have said, it was because of the sense of urgency which they had that in 1953 the Government set up the Committee of Inquiry. Its Report was published shortly before Christmas. I submit to the House and, in particular, to my hon. Friend the Member for Kidderminster, that we have not really been dragging our feet since then. No time has been lost. During the Recess the Government studied the implications of the Report, and when the House reassembled I was able, on the very first day, to announce that, while we reserved our position, as it was quite proper that we should do, about individual recommendations, the Government accept in principle the clean air policy advocated by the Committee.

I know that when one talks on the Continent about accepting something in principle it usually means that one disagrees altogether with everything, and it is usually the beginning of a speech of opposition to the whole idea; but, in our English language when we say that we are in agreement in principle it means that we approve the broad lines of what is proposed. When the Government do so in the present case it also commits them to taking action to implement it, and I can assure the House that that is so in this instance.

As I have said that we are in agreement in principle with the policy advocated by the Beaver Committee's Report, it follows, naturally, that the Government warmly support the objectives of my hon. Friend's Bill. We all admire the boldness, enthusiasm and pertinacity with which he has brought it before the House. Since we support the objectives of the Bill, our natural inclination is to support the Bill itself, and I can assure my hon. Friend and others who are sponsoring the Bill that it is in that spirit that we have examined the text of the Measure.

In its Report, the Committee defined the principles and objectives of a clean air policy. However, the process of translating them into an Act of Parliament inevitably raises a number of doubtful points which do not necessarily emerge in the text of a Committee's Report, points which one way or the other must be resolved. Some of these points may be of great importance to large sections of the community and may involve technical problems of considerable complexity. Wrong decisions might well prejudice the effective administration of the policy and easily lose us the goodwill of those whose support is essential for its success.

The implementation of the policy will, as hon. Members well know, have considerable repercussions upon the design of industrial plant and industrial re-equipment plans in general. It will extend the responsibilities of local authorities and entail the recruitment of a substantial number of technical staff and also their training, because some of the

more technical people are rather rare birds. Quite serious problems are raised by the considerable expansion which would undoubtedly be involved. As for the prohibition of smoke from domestic chimneys, this will involve changes at the family fireside which, at first, may not be universally welcomed.

If the new law is to be intelligible, practicable and reasonable, it must, we consider, be devised and framed in close consultation with those who will be most directly affected. In particular, we consider that we must have full consultations with local authorities, with industry, both employers and trade unions, and with various technical bodies whose advice we need.

As I told the House last week, these consultations have already started. They are going ahead satisfactorily, but, of course, they are not yet completed. In the light of these circumstances the Government have considered whether we could advise the House to adopt the text of my hon. Friend's Bill and we have most reluctantly come to the conclusion that we cannot do so for the following reasons.

First, the drafting of the Bill is, in our opinion defective, in certain major respects; secondly, it departs in some ways from the Beaver's Committee's recommendations, not only in those ways to which my hon. Friend the Member for Kidderminster (Mr. Nabarro), referred in his speech today, but in ways which we feel present certain quite serious difficulties; thirdly, because the Bill has of necessity been framed without full consultation with industry and with local authorities; lastly, through no fault of the hon. Member, because the Bill does not and, of course, could not contain the financial provisions which are necessary to make it fully effective.

We have also considered whether the Government might, during the Committee stage, help my hon. Friend to redraft and reshape the Bill and, at the same time, introduce the necessary financial Clauses, but there are quite serious difficulties about that. In the first place, I doubt whether it is really desirable for the Government to infuse large sums of public money into Private Members' Bills. The sums, although my hon. Friend regards them as trifling, do amount to quite considerable totals. For instance, one sum to which the Beaver Committee referred is £15 million over the next five years and there are various other expenses involved. But it is questionable whether we should infuse large sums of public money into Private Members' Bills. If this practice were to develop generally, there is no doubt that the whole character of Private Members' legislation would be changed.

Secondly, there is a limit to the extent of the changes which it is proper to make during the Committee stage of a Bill. Even assuming that it was right for the Government to give the Bill its financial teeth and that there were no constitutional objections to altering radically the form of the Bill in Committee, we are still up against a serious practical difficulty, which is that it would be most undesirable—and we should not be prepared to do so—for the Government to table their Amendments until the consultations which they are having with industry and local authorities are completed.

It would make a nonsense of these consultations, if, half way through, we were to table Amendments to a Bill in the House of Commons. However, by the time that these consultations are completed, I fear that the Committee stage of the Bill in all probability would be nearly over. Those are the difficulties which we see. In all the circumstances, I feel—and I think this view is shared, as I judge from some of the speeches made today, even by those supporting and backing the Bill—that it would really be much better and would avoid the risk of the confusion, if we were to have a Government Bill.

I should explain to the House where we stand on that, because I think that that is my main task today. I do not propose to enter into discussion of the merits of the policy. There is general agreement about the policy we want and the time for the Government to explain exactly where we stand on each proposition will come at a later stage. So far as Government legislation is concerned, this is where we stand.

As soon as the consultations to which I have referred are completed, the Government will frame and introduce a comprehensive Measure, including the financial provisions needed to make it effective. The Bill will follow the general lines of the recommendations of the Beaver Committee. I say " general lines," because I want to make it clear that that does not preclude us from considering other additional, or alternative proposals, such as have been put forward by various hon. Members during the course of this debate.

I can make no promise—and the House will not expect me to do so—about the date of the introduction of the Bill, except that there will be no avoidable delay and it will, of course, be introduced during the present Session. Whether the Bill will get through all the stages this Session will largely depend on how far it proves to be an agreed Measure. But, judging from the speeches to which we have listened today, there seems to be a very good prospect that hon. Members in all parts of the House will do their best to facilitate its passage.

I think that, on the whole, everyone, including my hon. Friend the Member for Kidderminster, is agreed that a comprehensive Government Bill would be much more satisfactory than the limited Measure which is before us today. Hon. Members have to choose between a small bird in the hand and a bigger bird in the bush, and I have no doubt that they will choose wisely.

Mr. H. A. Marquand (Middlesbrough, East): I take a special interest in the Bill because, though only for a brief period, I was responsible for looking after the public health of the nation. It was very much impressed upon me then, if I had never known it before, that prevention is better than cure. As the hon. Member for Wolverhampton, South-West (Mr. Powell) reminded us, the proposals in the Bill follow in the tradition of our great public health Measures.

We have had to impose compulsions to carry them out. There was a great rumpus at one time about compulsory vaccination. There were probably similar protests about the tuberculin testing of cattle, or the imposition of other compulsions about public sanitation. No less a philosopher than Herbert Spencer protested against compulsory sanitation and the formation of the sanitary districts which afterwards became the local authorities of the country. All these steps were approved by public opinion in the course of time.

Though the hon. Member for Bromsgrove (Mr. Higgs) sounded like those who criticized Lister and Pasteur in their time, perhaps before another generation has passed he will begin to approve and applaud and feel that he took a little part this afternoon in paddling this canoe safely to the shore.

The Minister has taken a bold step forward in saying that he will introduce legislation this Session, and I am very grateful. I know that I am speaking on behalf of all right hon. and hon. Members who placed their names on the back of the Bill submitted today in thanking the Minister for what he has said. We on this side of the House will gladly support him when he introduces his Bill and give him personally all the credit he deserves for what he has told us today.

Sir John Barlow (Middleton and Prestwich): This country lives by industry to such a large extent that it is up to the nationalized bodies dealing with fuel and power to see that there is sufficient appropriate material available to provide for its needs. It would be serious if smoke were prevented at the expense of the closing down of factories. That is not likely, but the possibility must be seriously considered.

We have been covered with smoke for so long that we consider it a necessary part of our lives. I believe that to be entirely wrong and incorrect, but we have allowed it to grow up through the centuries and have accepted it too easily.

Mr. Henry Usborne (Birmingham, Yardley): I believe it is necessary that an Act should be placed on the Statute Book making the emission of unnecessary smoke, grit and dirt a criminal offence. That has to be done, but I want to point out that a great increase in efficiency in firing is now taking place. This has been quite fantastic in the last two or three years and, incidentally, not very surprising. Industry and private individuals in their homes are at last becoming aware of the need to burn fuel more efficiently.

When fuel and labour were cheap, as they always were until very recently, it followed that an industrial community burned fuel without much care. Quite recently both fuel and labour have become very expensive items and, precisely because they are now expensive, all of a sudden industry and other consumers of fuel are naturally paying some attention to the way in which it is burned. Hitherto, they did not seem to care. Anything could be thrown into a furnace and it would burn, whether it was liquid or solid. Now it matters, and because it matters people are burning it more efficiently.

Nevertheless, because the pollution of the atmosphere is a social crime, it is necessary continuously to generate public opinion on the subject, and the great service which the hon. Member for Kidderminster (Mr. Nabarro) has done to the community and the House is that he has

introduced a Bill which has had a great deal of publicity, which has generated public opinion and which has made people more than ever conscious of the fact that it is advisable to burn fuel efficiently and is a crime to produce smoke and grit and to foul the atmosphere.

In this country as far as machines for the efficient burning of fuel are concerned, we are extraordinarily backward.

For example, in both France and Sweden some 15,000 domestic oil burners are now being installed every year. One of the oil companies gives the figure for this country as only 1,000. I think that that is too small and that it ought to be double that figure, but even if 2,000 oil burners a year in the domestic field are being installed in this country, the figures in France and Sweden are 15,000 a year and a million are being sold each year in the United States of America.

Mr. Ronald Bell (Buckinghamshire, South): May I offer my right hon. Friend some thoughts about fuel which may not be practicable but which are my own views? In places like London, where there is a tremendous concentration of human beings in different households, I am not sure that the burning of solid fuel in any form is really a satisfactory solution. I am inclined to think that what is called town gas is the right answer for London, or electricity generated under suitable safeguards at suitable distances. The by-products of gas can be burned in what may be called the secondary areas of lesser concentration, but I do not think that oil burning and coke burning is going to be a proper solution to London's problems.

Just as one aspect of that may I say that I hope we shall not press on, as it is said we are to, with the replacement in London of electric locomotion such as the trolleybus by diesel oil buses. Do not let us forget the pollution of the atmosphere from road traffic. Diesel fumes and the carbon monoxide of the ordinary motor car exhaust reach a fantastic concentration in certain atmospheric conditions in streets in central London. There is nothing more damaging to the general health and vitality of the human being than a consistent breathing of a fair concentration of carbon monoxide in the air.

Mr. Somerville Hastings (Barking): May I quote a word or two from a leading article in the *Lancet* of 2nd November, 1953, because it puts the case much more clearly than I can do. It is as follows:

> "Sulphur dioxide dispersed as one part per million throughout a gaseous phase might be relatively safe, but dissolved in droplets giving a local concentration thousands of times greater it will produce a strongly acid respiratory rain, which may readily produce bronchial spasm and oedema."

There can be no doubt that it is the sulphur oxides which do the harm, and it is suggested that smoke may come into the picture because sulphur dioxide on particles of smoke be more easily oxidized into sulphur trioxide and formed into sulphuric acid. That may or may not be true. I do not know of any very clear evidence for it but, even if it is true, it is bad enough to have sulphur dioxide producing sulphurous acid, if not sulphuric acid, in the air we breathe.

I do not feel that the Bill will take us very far as far as the health of the community is concerned, which is the only thing which gives me any justification for speaking. I know that the ridding of the atmosphere of sulphur oxide is a very complex and expensive problem. All I suggest is that the problem will not be solved by a childlike faith in smokeless fuels and smokeless areas.

Mr. Ivor Owen Thomas (The Wrekin): Sufficient attention has not yet been given to alternative sources of heat and power. What about schemes which are still blueprints for the utilization of the latent power that is available in all the rivers and estuaries around this country, the Severn Barrage, for instance? There will be no smoke, because there would be no coal. There would be no fumes. The sooner this Government, or some other Government, give more serious attention to the utilization of this hydro power the better. This power lies to hand around our coasts.

Mr. Philip Noel-Baker (Derby, South): I rise to say two things. I want to endorse the thanks and the congratulations which have been offered by my hon. and right hon. Friends to the hon. Member for Kidderminster (Mr. Nabarro) on his notable success today. Ever since he first came into the House he has laboured to make the Government, the House and the nation and even the most recalcitrant of all, Ministers of Fuel and Power, understand the vital problems which fuel and power policy involve. I hope that today we are taking a decisive step towards a solution of the most urgent and the most grievous of these problems. If so, it is

thanks to the hon. Member for Kidderminster and I am sure that neither the House nor the country will forget what he has done.

The second thing I want to do is to welcome, as did my right hon. Friend the Member for Middlesbrough, East (Mr. Marquand), the declaration made by the Minister. We are very glad that the Government are now to bring in a Bill and we hope that it will be passed this Session. I venture to add a warning to the Minister and his possible successors. The Government support the policy of the Beaver Report, but that policy cannot be made effective by legislation alone. It will need resolute and imaginative administration from all concerned, by Government Departments, local authorities and elsewhere. It will need the co-operation of a number of Government Departments. Above all, it will need adequate financial support.

In the past, I have sometimes tried to bring home to the House the heavy economic losses caused to the nation by certain social evils. They are losses which do not appear on the debit side of the Chancellor of the Exchequer's account. They are losses which do not enter into the consciousness of most people until, with a shock of surprise, they learn of them. Road accidents cost the nation at least £150 million a year and the cost is rising, an annual charge. Rats consume £30 million worth of foodstuffs every year, a major item in the balance of payments account. Now Sir Hugh Beaver tells us that smoke and the waste of coal costs us the fantastic sum of £300 million a year. They do not appear in the Chancellor's accounts, so the Treasury has treated them in the past as though they did not exist.

I tried, not very long ago, to get a subsidy of £3,000 for the Smoke Abatement Society, which has done magnificent work and achieved real and very important results. I failed to get it—a one hundred thousandth part of the annual loss which we suffer now. This problem must be taken very seriously indeed. I hope that the Beaver Report and the speeches of the hon. Member for Kidderminster and of my right hon. and hon. Friends today will have persuaded the Government and the administration of the country that air pollution is a major social evil, that the promised Bill must deal with it in a drastic fashion and that we cannot effectively tackle the problem without large-scale investment.

When I say " large-scale investment " I mean investment on a large scale, for £300 million is the interest at 4 per cent. on £7,500 million. There must be large-scale investment by the Government, by local authorities and by private firms. I hope that the Government will ensure that this can be done without the injustice to local authorities of which my hon. Friend the Member for Brightside (Mr. R. E. Winterbottom) was afraid.

In any case, we promise that, if the Minister's Bill will really do the job, we will help him to get it quickly through the House. We also promise that if a General Election should interrupt its progress the new Government will reintroduce the Bill and make it law.

I end by thanking and congratulating again the hon. Member for Kidderminster, the Smoke Abatement Society, which has lent him and his supporters such great help in the last few weeks, and also the Minister, who has promised us action which will end our evil practice of treating God's air as an open sewer.

Dr. Stross asked leave to withdraw his amendment and Mr. Nabarro then concluded the debate as follows:

In asking leave to withdraw the Bill I hope that I may be allowed to thank my right hon. Friend the Minister of Housing and Local Government for his unequivocal promise to introduce during this Session a comprehensive Measure which would have all the financial provisions necessary to give effect to a clean air policy.

I should like to couple with those thanks to him the names of the right hon. Gentleman the Member for Derby, South (Mr. Noel-Baker), the right hon. Gentleman the Member for Blyth (Mr. Robens) and the right hon. Gentleman the Member for Middlesbrough East (Mr. Marquand) together with eight other hon. Members of this House, of all parties, who have combined with me in the last few weeks in making today's debate possible as a result of my very good fortune in winning the first place in the Ballot.

Finally, my thanks are due to the Smoke Abatement Society of Great Britain for its unfailing help, technical advice and guidance during the last few months.

I beg to ask leave to withdraw the Motion and also the Bill.

Motion, by leave, withdrawn; Bill withdrawn.



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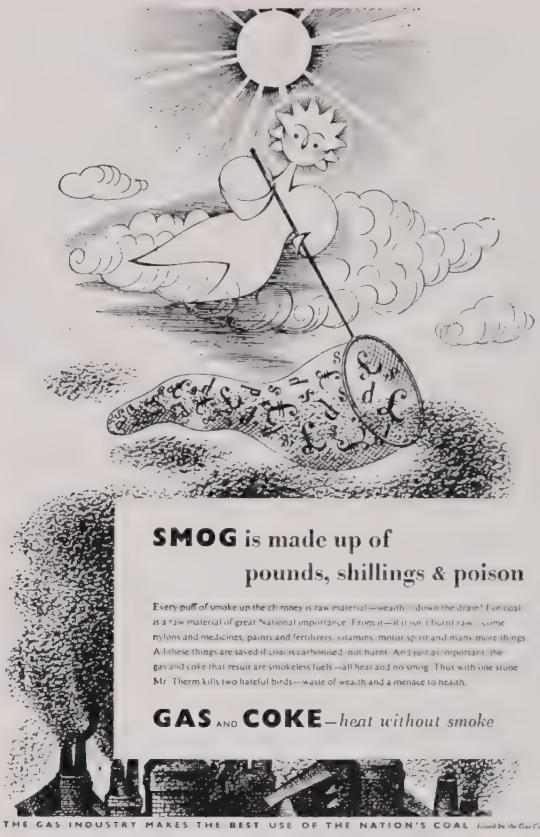
YOU BURN COAL RAW, and what happens? You make smoke, which makes smog, and you destroy the raw materials of a hundred different products from paint to motor-spirit, from nylons to fertilizers. Smoke is not only a menace to health—it is the funeral pyre of wealth.

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SCOTTISH CONFERENCE

A joint conference under the auspices of the National Industrial Fuel Efficiency Service and the Scottish Division of the N.S.A.S. was held in Glasgow on February 9th, with an attendance of about 200. One of the principal speakers was Mr. W. B. Kennedy, Smoke Abatement Officer for Manchester, who explained how the Manchester smokeless zone had been established, why it had been so successful and how " prominent manufacturers demanded that the zone be extended."

Dr. Joy P. Stern of the Scottish Division of the National Coal Board said she had been depressed by the emphasis given to domestic smoke. The views of the housewife were not represented. She criticized the use of smokeless fuels and wanted more research into the burning of coal smokelessly in the home.

Other speakers included Mr. John Innes, President of the Scottish Division of the Society, Sir Patrick Dollan, Dr. Stuart Laidlaw, and Mr. John Page, of Kirkcaldy, who described the new system of electric heating in a block of flats in his town. The conference passed a resolution thanking the Government for their pledge to introduce new legislation.

The Effects of Flue Gas Washing

A Paper with the full title " Effects of Velocity and Temperature of Discharge on the Shape of Smoke Plumes from a Funnel or Chimney: Experiments in a Wind Tunnel," by L. W. Bryant, B.SC., and C. F. Cowdrey, B.SC., was read to the Institution of Mechanical Engineers in London on 11th February, 1955.

It described and discussed experiments carried out in the Aerodynamics Division of the National Physical Laboratory on behalf of the Admiralty. The paper is largely of a mathematical nature, but the conclusions reached with regard to the advantage of washing the effluent of a chimney stack are summarized as follows:

(1) The loss of buoyancy of the effluent which results from washing destroys the advantage of the reduction of sulphur dioxide content at the exit so long as the turbulence of the air is less than that corresponding to wind of speed of the order of 15 m.p.h.

(2) The advantages of washing become more pronounced as wind speed and turbulence increase. It is sufficient to consider conditions of moderate wind of speed of the order 20 m.p.h., rather than any less speed. Higher winds in built-up areas in Britain occur usually less than one day in sixty.

(3) With a given volume rate of discharge of the effluent gas, there is a critical diameter of exit for the stack above which the maximum concentration of sulphur dioxide is greater for the washed than for the unwashed plume. If the height of the stack is 100 feet or more this critical diameter is greater than 30 feet.

(4) If the height of the stack is not less than 200 feet, the greatest concentration of sulphur dioxide anywhere on the ground will not exceed 1/1000 of the concentration at the exit if the effluent is unwashed, so long as the speed of the wind is not much above 20 m.p.h.

(5) Maximum concentration occurs much nearer the stack when the effluent is washed than when unwashed. Increase in height decreases the maximum concentration and causes it to occur farther from the stack. Even when the maxima of washed and unwashed smoke are approximately equal, the concentration of sulphur over a very considerable area beyond the first $\frac{1}{4}$ mile from the stack, is very much greater in the latter case than in the former.

(6) When washing is decided upon, the velocity of exit of the effluent gases should be as high as possible. This can be arranged if necessary by reducing the diameter in nozzle fashion at the top of the stack.

(7) When it is required to consider concentrations at a level comparable with the height of the chimney, it will be found that they will be notably greater than concentrations on the ground for a stack 50 feet high, and they will be very little altered by variation of stack height. In these circumstances washing is advisable, unless the site under consideration is sufficiently far, say one mile, from the stack.

(8) When a power station is situated in a built-up area with buildings of very uneven height, or in a countryside of a hilly nature, it is suggested that a model test is invaluable to determine the course of the smoke plumes as influenced by the contours of the surroundings.

Manchester's Director of Cleansing, Mr. A. E. Barton, in his annual report to the City Council says that in the smokeless zone the weight of ash and clinker in refuse may be reduced, but other refuse—paper and cardboard—which used to find its way into the open fire or the central heating boiler, now tends to increase collection costs rather than to reduce them.

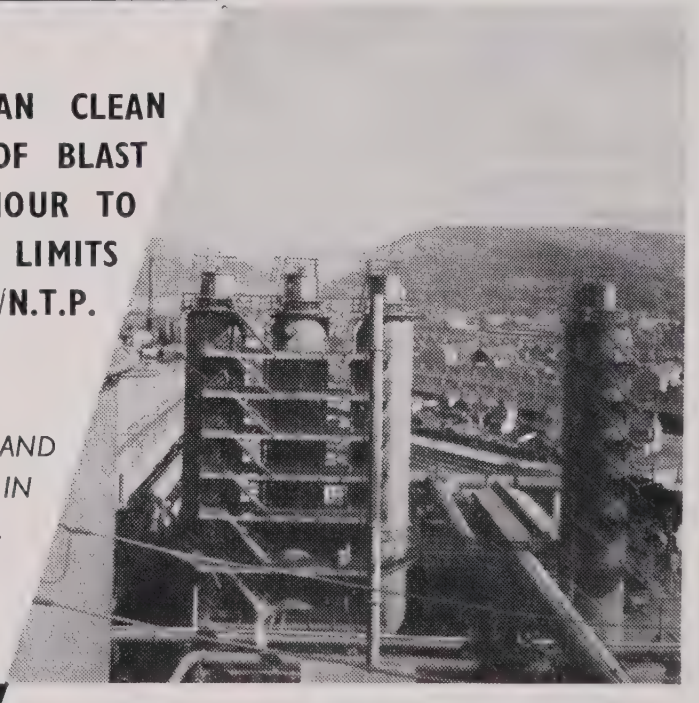
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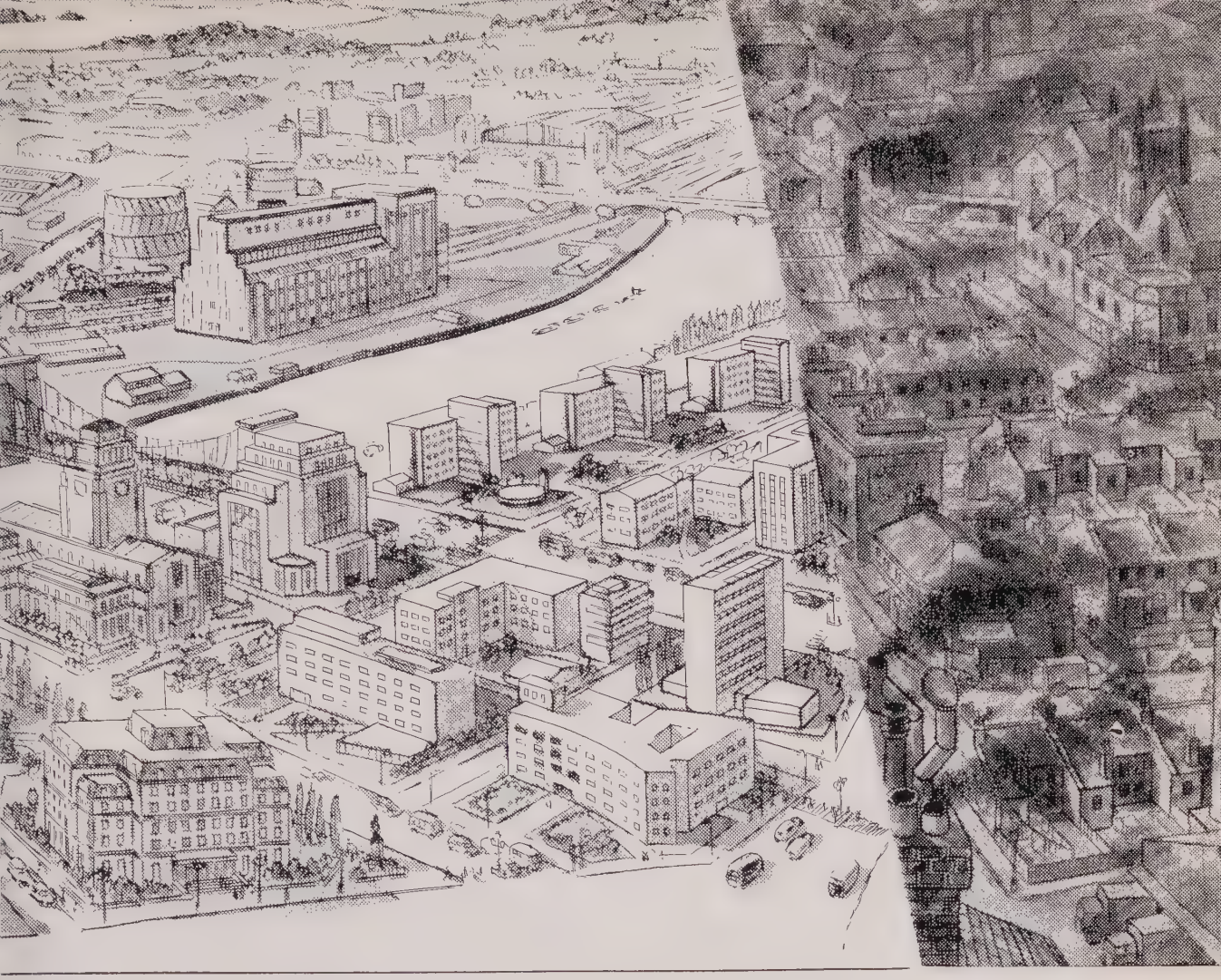
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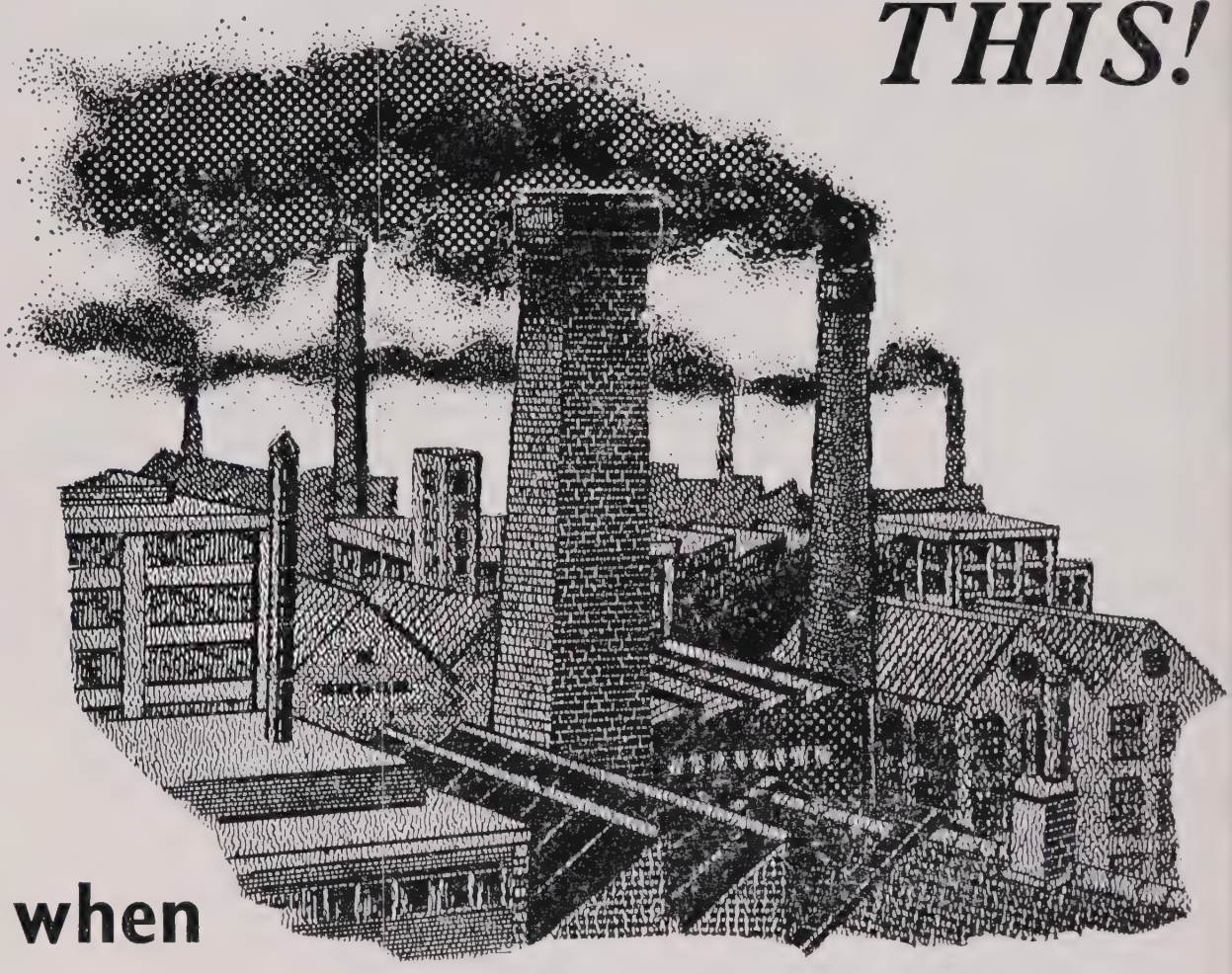
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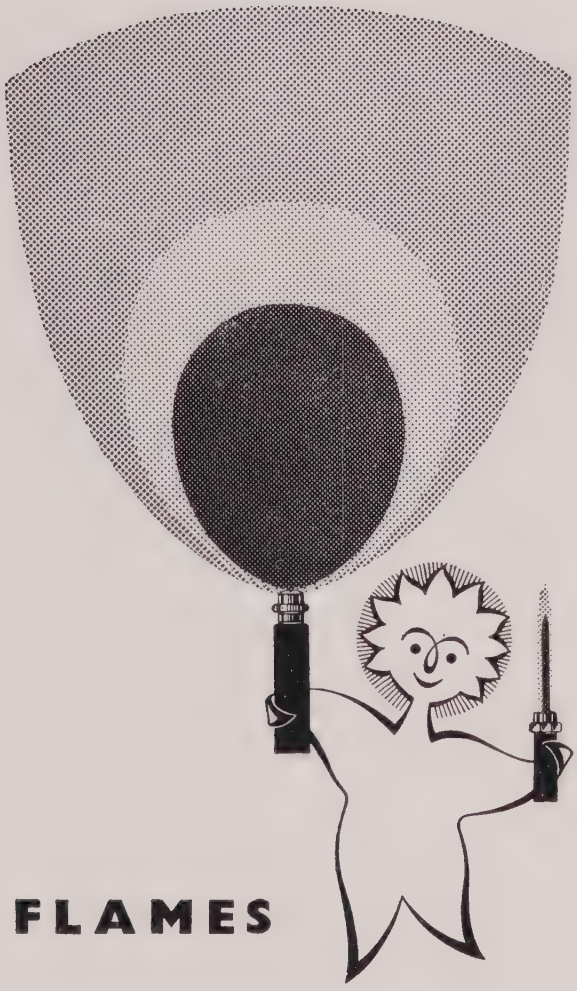
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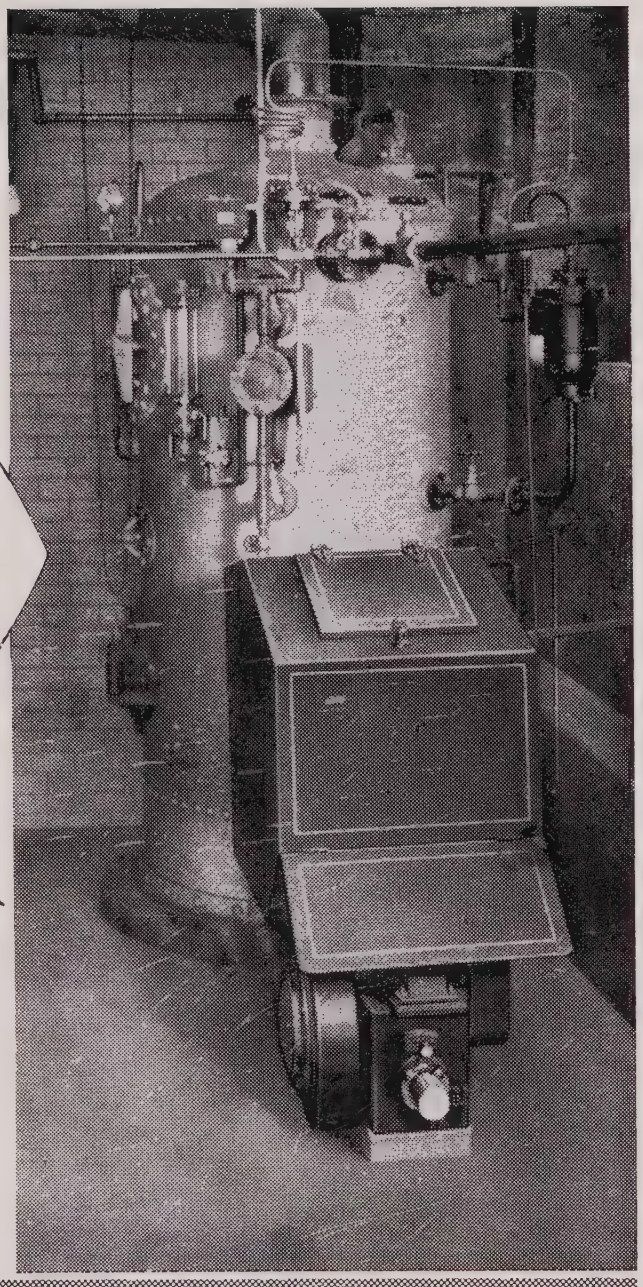
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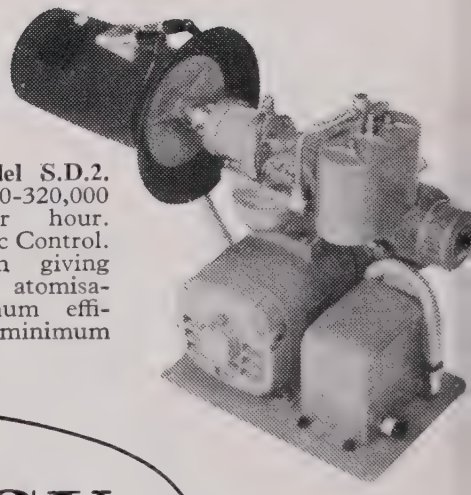
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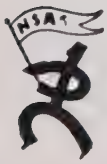
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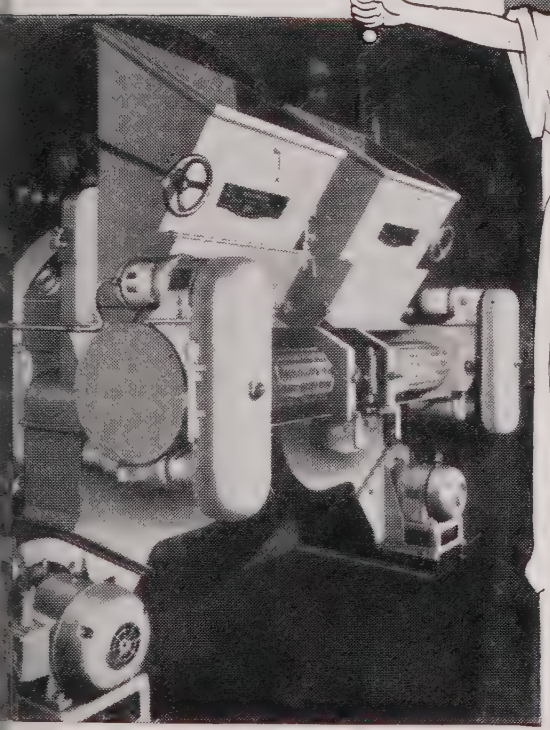
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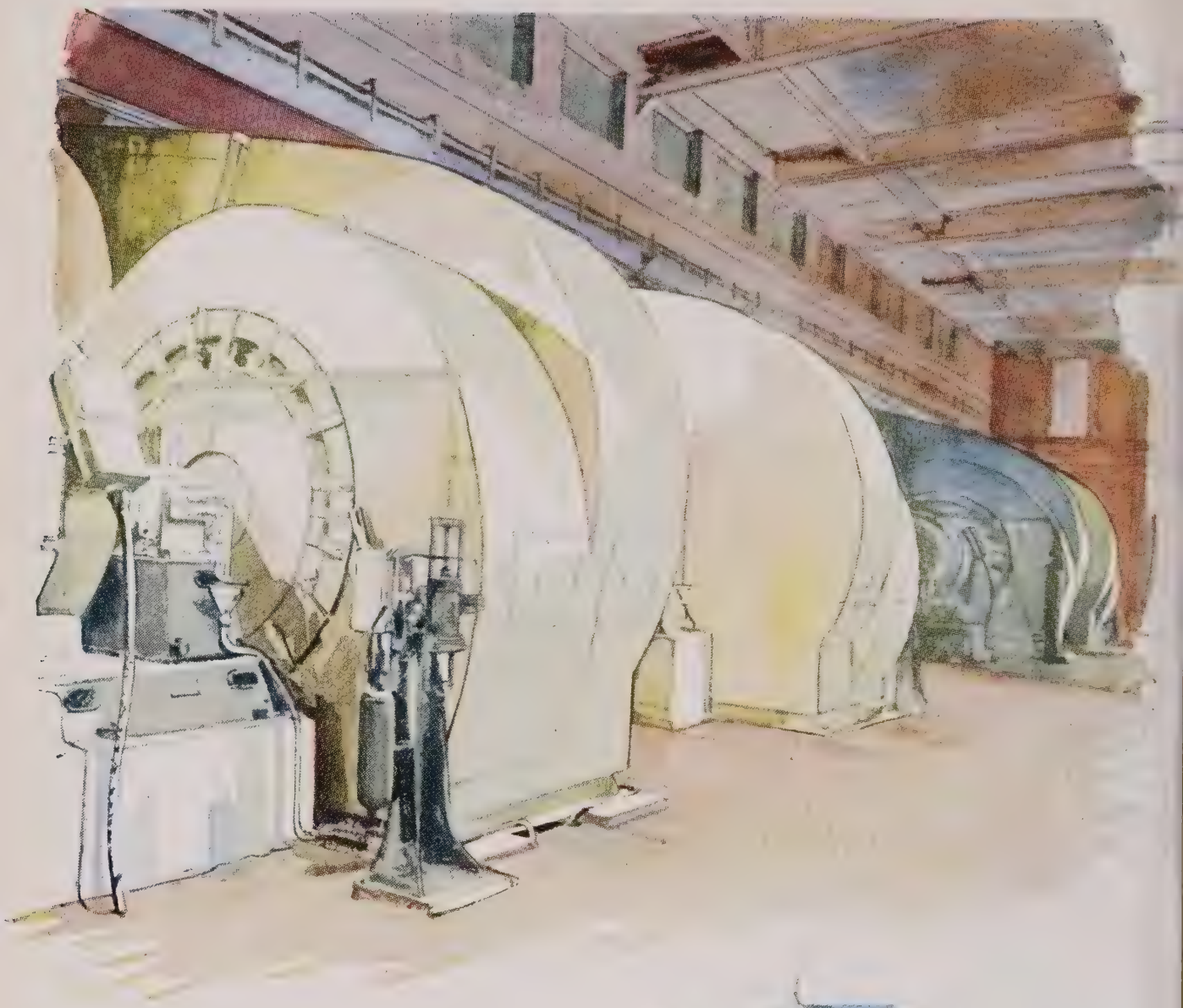


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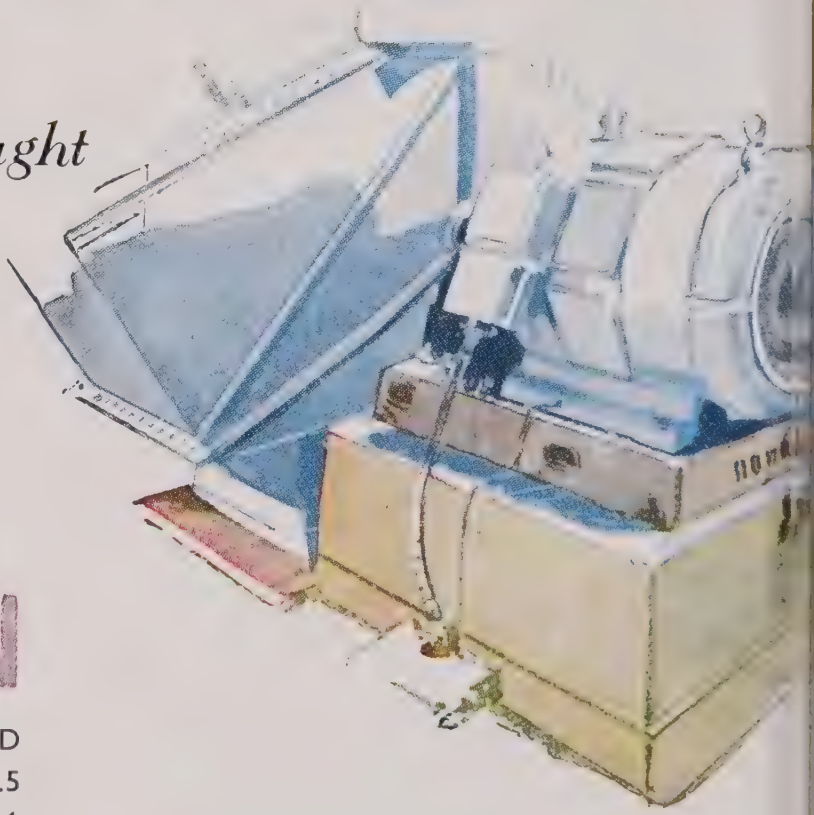
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In this Issue

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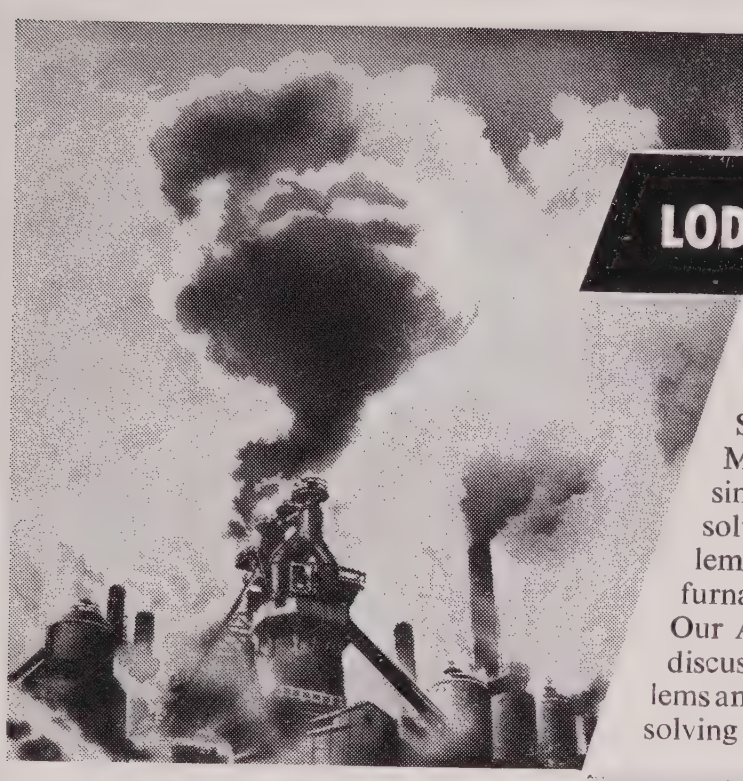
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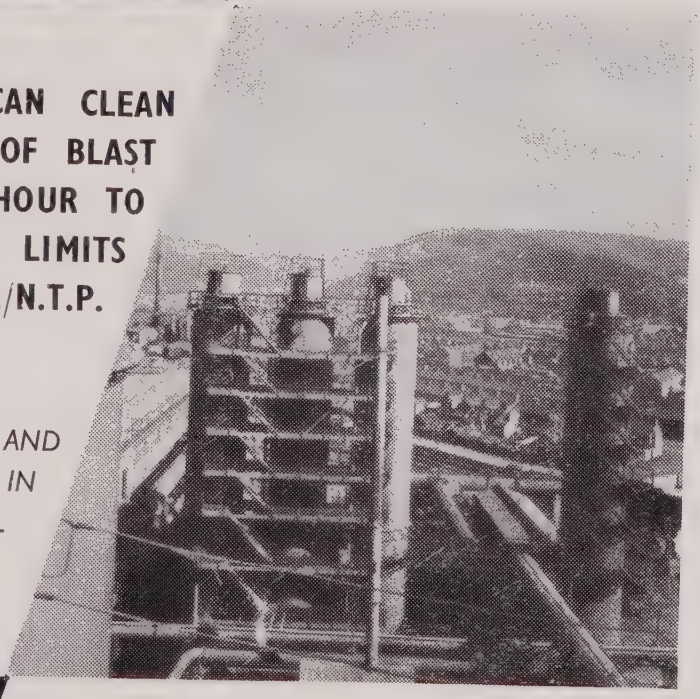
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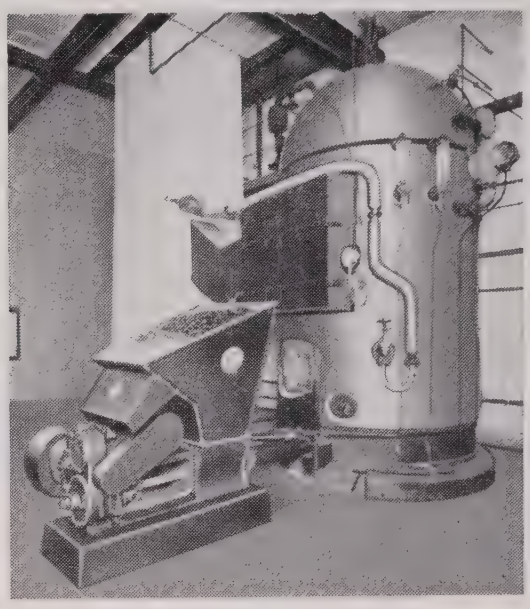
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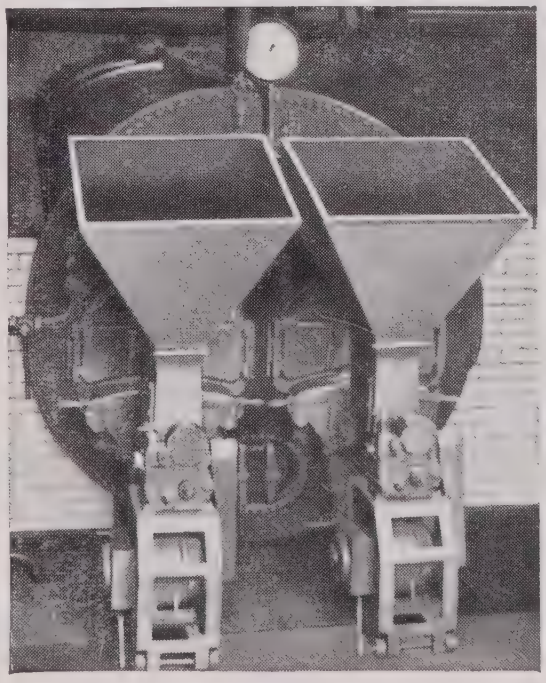
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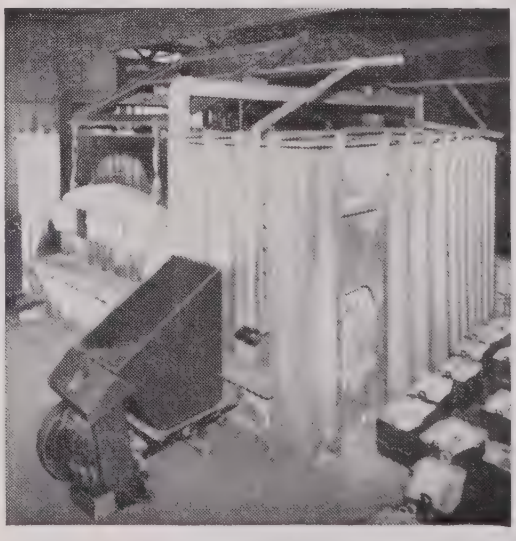
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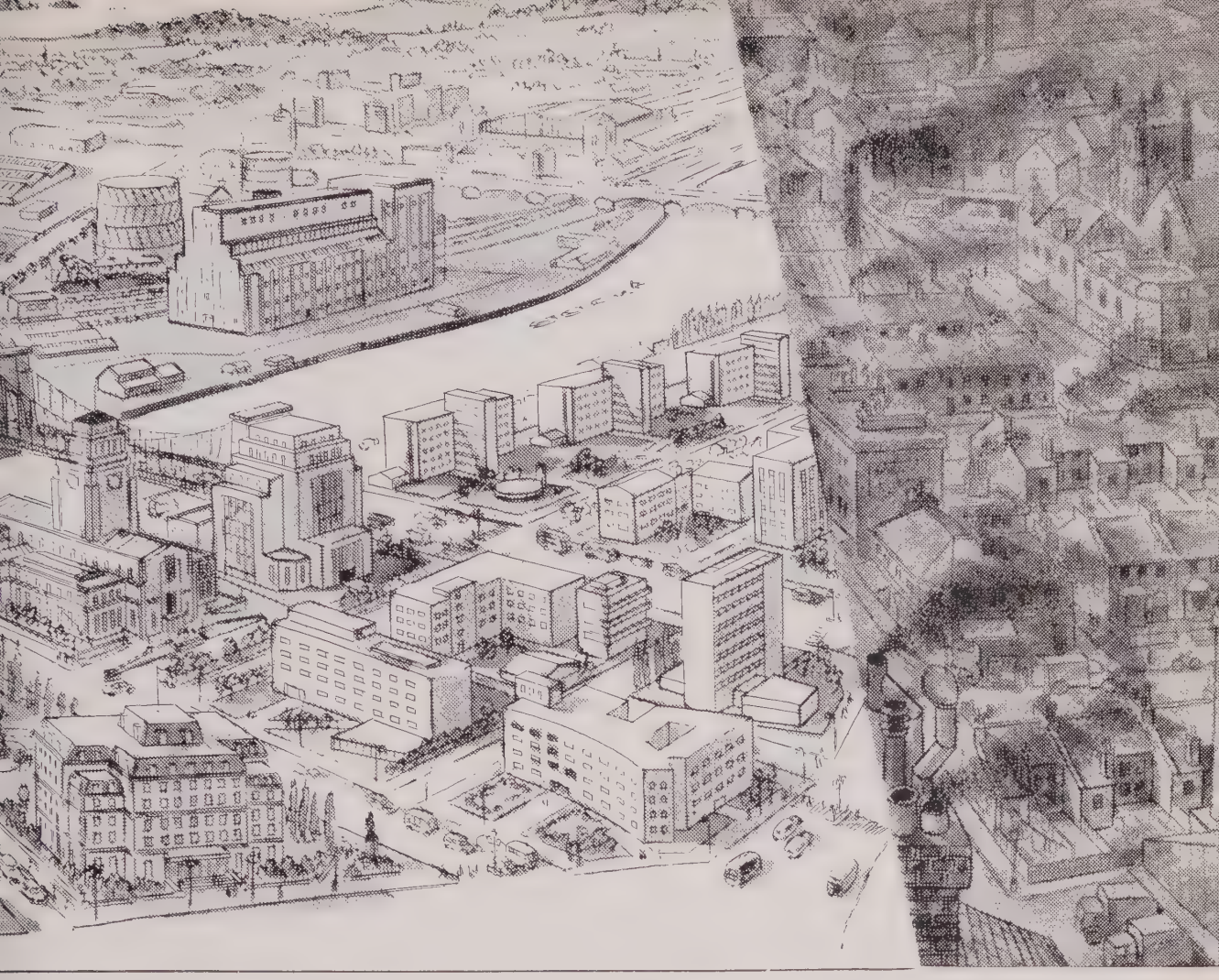


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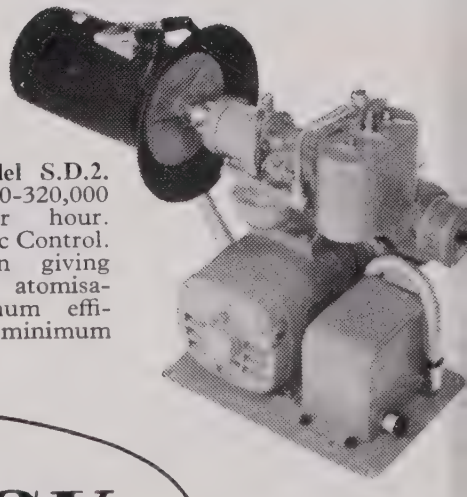
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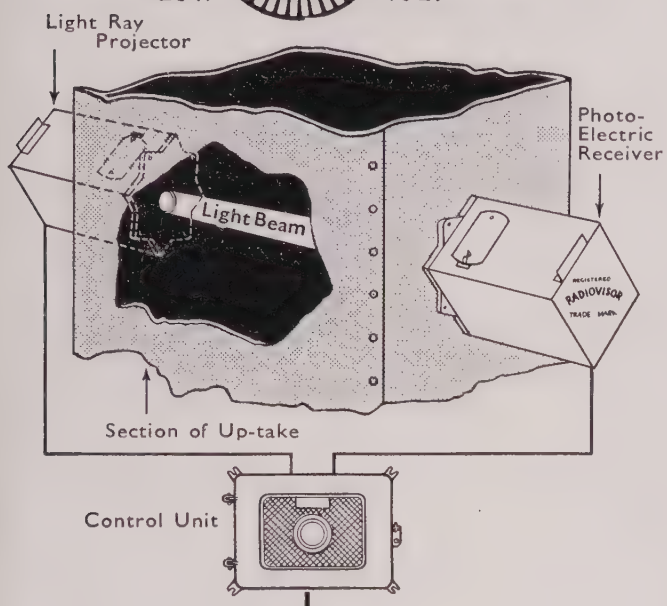
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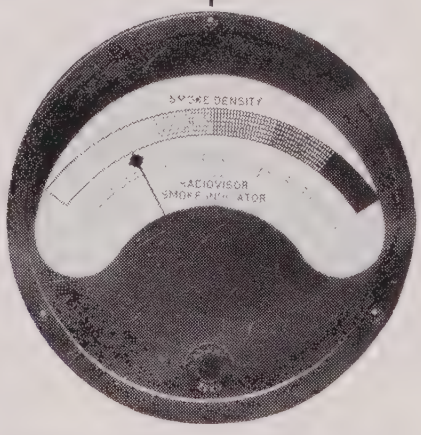
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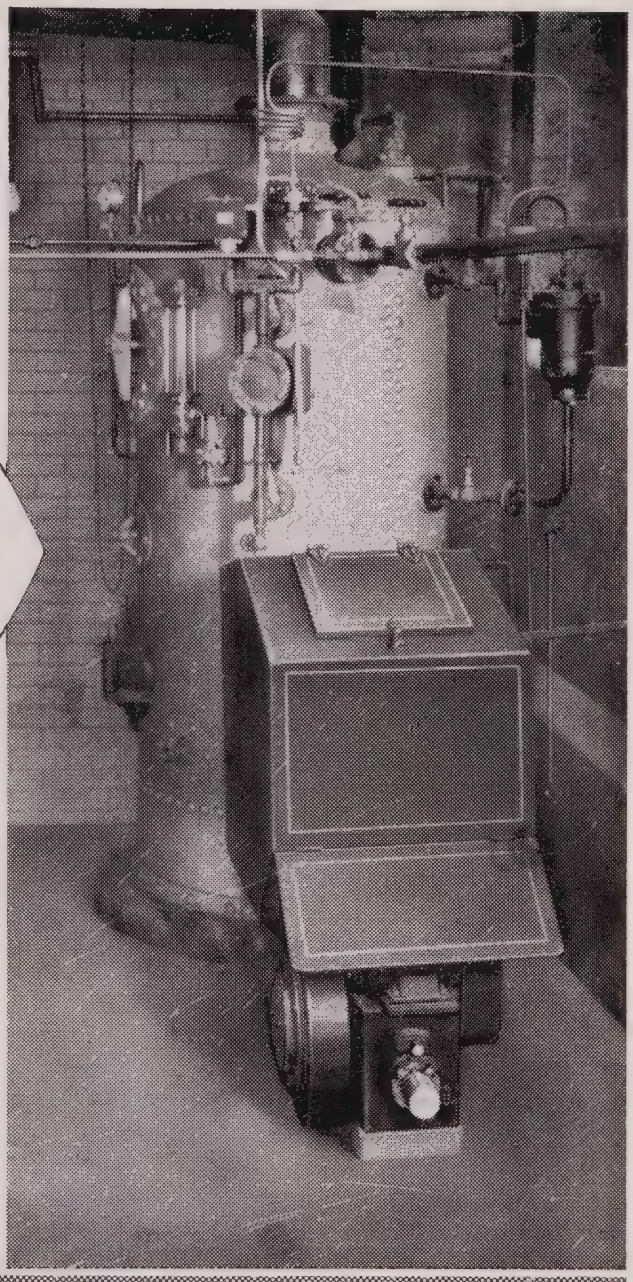
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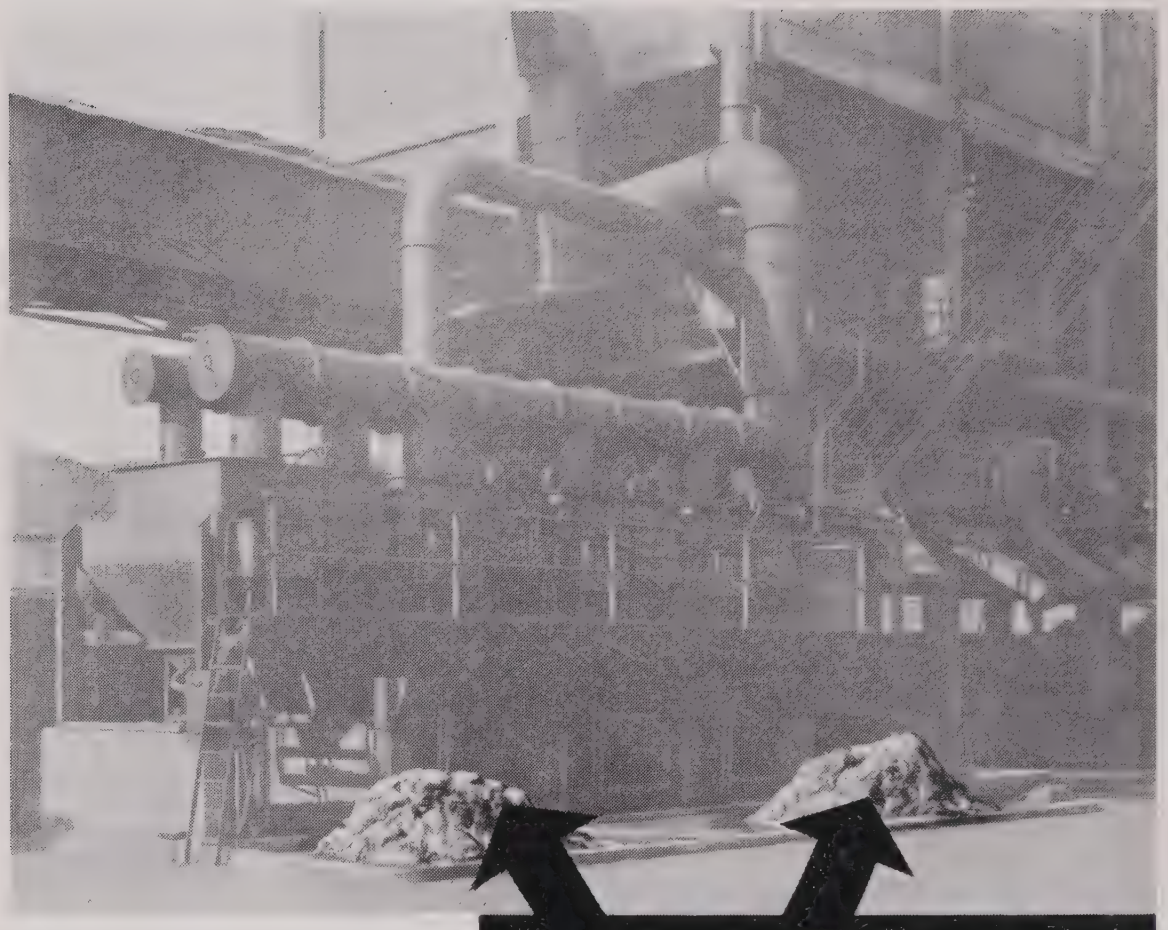
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SMOKELESS AIR

Vol XXV. No. 94 Summer, 1955

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SMOKELESS AIR

Waiting for the Bill

THE Government's undertaking to introduce an air pollution Bill " during the present session " was nullified by the Government's decision to hold a General Election in May. But we believe the Bill is well and truly on its way, and we understand that consultations have been held with local authority and industrial organizations about its provisions. It may not be long, in the new Parliament, before it is " laid " and so made public—and then discussion can be unconfined. As we go to press, however, it is rumoured that the Bill is not likely to be introduced during the present short session, before the summer recess. It may therefore be well into 1956 before it is on the statute book.

The Society

Although the contents of this issue range far and wide these editorial notes could be devoted wholly to the Society and its affairs. We will, however, be brief. First, we would ask all readers to note our change of address—the second in little over a year. We are hoping, for more reasons than one, that we shall stay put in our new quarters for some years to come. It may be of no significance, but the offices are now as near to the Houses of Parliament as they can be.

Next, we ask readers to note the

details on another page of the Bournemouth conference to be held in September, and to do their best to be present. The Thursday sessions will be of exceptional importance to all local authorities and we are waiting to see if, as seems likely, the attendance breaks all records. Thirdly, and lastly, the Executive Council has been considering how the Society's constitution, which was adopted in 1946, needs revision in view of its considerable growth since that time. The matter is being studied by a small committee and in all probability a resolution on amendments for the approval of the annual general meeting at Bournemouth will be submitted beforehand to members and representatives. It would be helpful to receive any suggestions members may have for this revision.

Question in the House

Although we did not prompt it, we appreciate Mr. Noel-Baker's question in the House of Commons about the Society. On 8th March he asked the Minister of Housing and Local Government whether " he will arrange for a subsidy of £3,000 per annum to be paid from Government revenues to the Smoke Abatement Society."

Mr. Sandys: Most useful work is being done by the National Smoke Abatement Society, but it does not necessarily follow that a Government subsidy is called for.

Mr. Noel-Baker: Is it not a fact that the Society's work could be very usefully expanded by means of a subsidy of this kind? Since the annual loss to the nation is £300 million a year, and since the Society has achieved very appreciable results in the past, would it not be a very sound investment?

Mr. Sandys: I am not unsympathetic to the right hon. Gentleman's point of view, but there are so many deserving causes to which subsidies could be given.

Mr. Noel-Baker: In view of the urgency of this matter, would it not be a very good plan for the Minister to win a victory over the Treasury upon it?

Mr. Hastings: Is not this organization already receiving large sums from firms which make smokeless fuel?

Large Sums

Mr. Somerville Hastings's interjection was rather less than kind and regrettably misleading. The Society does not, unfortunately, receive from anyone what, in this context, can be called " large sums." We are glad to have support from smokeless fuel and other industrial interests, and only wish it were more; but compared with the contributions received by other bodies promoting the better use of fuel, and all that is spent on publicity, the Society is still very much the poor relation. It need only be pointed out that our annual income, from all sources, and after many years of appeals in all directions, has only now just reached the £8,000 level. Mr. Hastings has perhaps unconsciously paid the Society a tribute, as others have done, in assuming from the impression we create that we enjoy a far bigger income than in fact we do.

The question of whether it was proper for the Society to seek and accept support from commercial interests was debated and settled many years ago. The old Coal Smoke Abatement Society had refused to do so, and had barely managed to keep in existence. The present Society decided to accept commercial members on condition (which has always been respected) that they did not seek to influence its independence, and indeed it is only through their help, together with that of the local authority and individual members, that it has been possible to develop a national smoke abatement organization. The variety of different interests within the Society does in fact ensure a healthy independence and a usefulness that could never be attained by a body with any kind of closed shop membership.

Those Vested Interests

Allied to this jab at the Society is the sniping at the smokeless fuels and

their makers, as quoted in the article on the sulphur controversy on another page. The view of the *Medical World* that " vested interests are growing up in the production of these fuels and dispassionate assessment of their value is becoming difficult in a press which carries many advertisements extolling their virtues," reads amusingly to those in the smoke abatement movement who have for so many years been urging, demanding, pleading for more interest, vested or otherwise, in such fuels. It has even been touch and go whether the most widely available solid smokeless fuel, coke, might not begin to disappear if the proponents of total gasification won the day, and there have been endless disappointments and delays in the development of other fuels and processes. Even now, in this post-Beaver era, the vested interests need more encouragement and, maybe, more pushing. In any case, it is an odd argument that condemns a useful product because of its commercial basis. There are even vested interests behind the antibiotics and other preparations that are so richly advertised in the medical journals.

Highly Commended

The material being published at the present time on air pollution is remarkable for its quantity. Only a fraction can be reviewed or mentioned in this journal, but we would like to commend to our readers the following three publications. The *Birmingham Post* showed enterprise and skill in its publication on 31st March of a Fuel Efficiency Supplement. Among the many excellent articles were two on air pollution aspects, by the Chairman and Hon. Secretary of the Society's West Midlands Division.

Weather, a monthly magazine published by the Royal Meteorological Society (49 Cromwell Rd., London, S.W.7. 2s.), devoted most of its April, 1955 issue to the problems of air pollution and smog. These included a somewhat speculative article on fog by Dr. Meetham, a general article on air pollution by Dr. W. C. Turner, of which the most interesting part was his review of the physiological aspects, a helpfully informative article on " Plumes from Tall Chimneys" by R. S. Scorer, a review of the Beaver Report by Dr. Horace Joules, and an account of summer visibility across London by L. C. W. Bonacina.

The third publication is the April, 1955 issue of the Journal of the Institute of Fuel (18 Devonshire St., London, W.1., 10s.). This contains the reports of the two remarkable meetings of the Institute at which the Beaver Report was discussed. Among those taking part, and whose remarks are here recorded, were Lord Simon of Wythenshawe, Sir Hugh Beaver, Dr. Foxwell (who opened the discussion), Mr. Nonhebel and many speakers from the fuel and power industries. Representatives of these vested interests had, in fact, a great deal to say (as the *Medical World* might like to note) but it was most useful that they were present and did so. Altogether this is a most informative—and enlightening—record of what technical opinion is thinking about the Beaver Report.

Change of Address

Please note that the Society's Offices are now situated at

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RADIOACTIVE POLLUTION FROM NUCLEAR EXPLOSIONS

An Address by

Sir John Cockcroft, K.C.B., C.B.E., F.R.S.

to the

Parliamentary and Scientific Committee on 29th April, 1955

THERE has recently been a considerable amount of discussion in Parliament on the biological effects of nuclear explosions. I will therefore try to supplement what has already been said in the course of the debates. The greatest interest appears to be taken in the world wide contamination which comes from test explosions and so I will deal with this first.

Radiation from Nuclear Explosions

The most important source of contamination is the hydrogen bomb since it produces 100 to 1,000 times more radioactive material than an atomic bomb. The contamination is, however, of the same kind. The same radioactive fission products are formed and their activity decays in the same way. Thus the gamma ray intensity decreases by a factor of 50 between one hour after the explosion and one day. At the end of ten days it has decreased by a further factor of 20 and after one hundred days by a further factor of 10.

The explosion of a hydrogen bomb on the ground mixes millions of tons of soil with the radioactive products. Particles of all sizes from 0.02 in. diameter down to less than 0.001 in. are produced. These particles are transported by the wind. The larger particles fall out quickly. A large proportion of the radioactivity may come down in this local fall-out of the larger particles. The remainder of the radioactivity is dispersed into the stratosphere—above 50,000 feet—and is carried on very fine particles. These travel round and round the world, gradually spreading out and falling out slowly over a period of years. Air burst hydrogen bombs differ from ground burst bombs in that practically all the radioactivity will go into the stratosphere and from there be deposited fairly uniformly.

In this country we have monitored the contamination of the atmosphere by flights with aeroplanes carrying filters and by measurement of the radioactivity precipitated in rain water. From the aeroplane measurements we know that the intensity of radioactivity in the stratosphere arising from the explosions is very much greater than the activity at ground level. From the rain water measurements we can determine the amount of radioactive contamination which is deposited on the ground. We can then calculate an upper limit to the gamma radiation which is emitted by assuming that the radioactive products have not diffused far into the ground and that the radiations from them are not appreciably absorbed.

We find that the average concentration of radioactivity in the air at ground level due to bomb explosions of all types over the last three years amounts to about 1 per cent of the average natural radioactive dust content. The highest peak of activity was half the average natural level. The natural level itself fluctuates and in some periods reaches 15 times the average level. This is probably due to changes with meteorological conditions in the concentration of the natural radioactive gas, radon, which comes out of the ground. Professor W. V. Mayneord has observed even higher fluctuations in London under special meteorological conditions and these may be connected with the combustion of fuel.

Coming now to the radiation or

radioactivity effects of bomb explosions on human beings, I shall employ the recognized term roentgen, the commonly accepted unit of measurement of radiation dose from x-rays or gamma rays. The accumulated dose which will ultimately have been received in this country by completely unprotected people from the fall-out that has occurred so far is about 0.01 roentgen. An additional dose will be received from the fall-out of the debris which is still airborne. This is expected to increase the total dose to 0.03 r. In the United States where local fall-out from Nevada is important, the average dose received from bombs so far exploded will total 0.1 r. The actual dose varies by a factor of 2 in different areas.

It is important to note, however, that the radiation is strongly absorbed by brick houses and in the lower part of a house the radiation level is decreased about 20 times. Since the average person spends a good deal of time indoors, the dose received will be reduced by a factor of at least 10. The radioactivity will also be washed down drains and into crevices in the ground, and the radiation thus further reduced. The average dose in this country is thus likely to be less than 0.003 r. over a generation. How small this amount is can be judged from the fact that natural sources of radiation in the ground, cosmic rays, and the natural radioactivity of the human body give us each a dose of 3 r. over a generation of 30 years, and that in some parts of the world—such as Tibet—where the cosmic ray bombardment is more intense the dose goes up to 5 r. without any very obvious effects. So our additional dose from bombs so far exploded is something like 1,000 times less than our natural dose.

I will now turn to the much debated genetic effects. The effect of radiation is to increase the natural mutation rate of the genes responsible for transmission of hereditary characteristics. The mutations produced by radiation are identical with the naturally occurring mutations, which have widely varying effects ranging from pre-natal death and serious malformation to minor disabilities such as loss of fitness, personality defects and minor mental changes. For example one troublesome natural gene produces about 2,000 abnormalities of a particular type in our population. These mutant genes are transmitted from generation to generation as a genetic load of ill health until they are eliminated by death before reproduction or failure to reproduce.

H. J. Muller, one of the world's leading geneticists, considers that to double the natural mutation rate generation after generation would produce disastrous results in a civilized population. In his opinion, it is advisable as a protective measure to limit the dose received before reproduction to a quarter of the doubling dose, so that the mutation rate would not be increased by more than 25 per cent. It is probably fair to say that the opinion of geneticists would differ widely on the maximum possible level.

The best evidence on the radiation dose required to double the natural mutation rate in mammals comes from experiments with large radiation doses on mice in the Oakridge Laboratory of the United States Atomic Energy Commission. These suggest a doubling dose of about 50 r. for mice. The extra-polation from mice to men is obviously an uncertain one. There is also a variation from gene to gene. If we accept Muller's criterion and apply the result for mice to men, it would restrict us to a dose of 12.5 r. per generation.

I have said that from the bombs exploded so far the radiation dose received by most of us shielded by houses and offices will be less than 0.003 r. per generation. We are therefore several thousand times below Muller's maximum level and our additional dose from bombs so far exploded is perhaps 1,000 times less than the dose we receive from natural sources.

Other harmful effects of test ex-

plosions have been suggested in a recent communication by C. Noel-Martin to the French Academy of Sciences. He suggested that a 20 megaton bomb could form 500,000 tons of nitrous oxide gas leading to production of nitric acid and a harmful increase in the acidity of rain water. He also stated that a ground explosion of this magnitude would send up 1,000 million tons of matter and that this would appreciably diminish the transmission of solar radiation. He further considered that enough radioactive carbon 14 might be formed to increase the natural radiocarbon content of the atmosphere by 10 to 30 per cent. We have made some estimates of these effects at Harwell. American figures for the production of nitric acid by explosions suggest that Noel-Martin's estimate is about 10 times too high. The amount produced by thunderstorms every day is likely to be about equal to that for one hydrogen bomb explosion, so this effect cannot be important.

We have experience from the Krakatoa volcano explosion (1883) of a diminution of 10 per cent in the intensity of sunlight at the earth's surface due to the dust thrown into the atmosphere. This has been variously estimated at between 100 million tons and a figure 200 times higher. This great amount of dust had no effect upon the weather. Our own measurements of the amount of additional dust in the atmosphere due to nuclear explosions suggest that it is 30 times lower than Noel-Martin's estimates. The effect on solar radiation and weather must therefore be extremely small.

The radioactive carbon produced by a large thermonuclear explosion has been estimated at 300,000 curies. This will rise into the stratosphere and diffuse slowly downwards. The equilibrium amount will then be only one thousandth of the amount naturally present in the atmosphere—produced by cosmic rays. Since this natural carbon 14 contributes only 1 per cent to the natural dose to the human body, the effect is negligible.

If we turn from test explosions to the radiological effects of a full scale hydrogen bomb war the picture is a very different one. A great deal of information has been released by the United States Atomic Energy Commission on the radioactive fall-out from the Bikini hydrogen bomb explosion of 1st March 1954. The Commission reported that an elongated cigar-shaped area down-wind from the explosion about 200 miles long by up to 40 miles wide was heavily contaminated by the radioactive fall-out. In an area 140 miles in length and up to 20 miles in width the lives of all persons who did not take shelter would have been seriously threatened. For example, on one part of Rongelap Atoll, 110 miles away, the total dose in 36 hours was 2,000 r. Some distance further from the point of detonation, at about 160 miles down-wind and along the axis of the ellipse, the amount of radioactivity would have seriously threatened the lives of about half the people in the area who failed to take protective measures, *i.e.* proper shelter from the radiation. It is estimated that the radiation dosage at that point was about 500 r. for the first 36 hour period.

Near the outer edge of the cigar-shaped area and extending approximately 190 miles down-wind, it is estimated that the level of radioactivity would have been sufficient to have seriously threatened the lives of 5 to 10 per cent of any persons who might have remained exposed out of doors for the first 36 hours. In this area the radiation dosage is estimated at about 300 r. for the first 36 hour period. The Japanese fishermen at a distance of 85 miles from the explosion received a dose estimated by Japanese radiologists as over 100 r.

The Home Secretary has spoken in the Defence Debate on the consequences of fall-out for Civil Defence in this country. Those living outside the areas destroyed by blast and heat but exposed to heavy radiation would have at once to seek shelter in houses

or other buildings. Measurements carried out at Harwell have shown that an ordinary brick house would probably reduce the intensity of radiation by a factor of at least 20, whilst additional shelter can be provided by a cellar or slit trench.

The Americans have said that an old fashioned cyclone cellar with a covering of earth 3 feet thick reduces the radiation intensity by 5,000. Having taken shelter the occupants would have to stay inside until the radiation intensity had fallen to such a level that they could go out—at first for short intervals and then for longer periods. However, even after one week from the explosion, 36 per cent of the total dose has still to be delivered. In other words, in a zone contaminated so that the total long term dose would have been 1,000 r. people coming out of shelter after one week for eight hours a day could still receive a long term dose of 120 r. Under these circumstances, a very large part of the population might receive more than the doubling dose. It is hardly conceivable, however, that such an experience could recur in successive generations and the genetic effect would seem to be a minor part of the overall catastrophe.

The world wide contamination from a full scale hydrogen bomb war can best be estimated by scaling up our estimate of the dose of 0.03 r. which would be received in the open in this country from all bombs exploded so far. If the number of hydrogen bombs were to be 1,000 times the number so far exploded, which seems unlikely, there would be a hemisphere contamination corresponding to a dose of about 25 r. This would be somewhat beyond Muller's danger level if the experience were to be repeated generation after generation.

Before I leave this subject, I will try to dispose of another popular horror—the so-called cobalt bomb. There seems to be a general belief that still more lethal types of bombs could be produced by incorporating cobalt into a hydrogen bomb and that such bombs might poison the whole earth. Our studies lead us to the conclusion that there is nothing in this idea—the cobalt bomb would offer no advantages to a lunatic designer.

Radiation from Nuclear Power Development

The large scale development of nuclear power from uranium fission will necessarily produce large amounts of radioactive waste having properties identical with those produced in nuclear explosions. The radiations are, however, mainly confined to the nuclear reactors which are the source of heat for nuclear power stations and to the chemical plants where the radioactive wastes are extracted from the spent uranium fuel.

The radiation in the vicinity of the nuclear power units can be kept below the internationally agreed safe levels without difficulty by the use of suitable shielding. The average radiation dose received by Harwell workers is 0.25 r. per annum. This is one sixtieth only of the level agreed internationally as permissible for the radiologically employed workers. The chief hazards at Harwell seem to be associated with the possibility of people dropping heavy weights on their toes, getting splinters in their eyes and moving into or out of the main highway which runs past the Establishment.

The public health problems are thus largely transferred to the chemical processing plants. The radioactive waste products include radioactive gases such as radiokrypton and xenon; these are at present allowed to escape from the processing plants in conformity with safety regulations so that no harm can be caused to the neighbourhood. It is likely that in future they will be bottled and turned to useful purposes. The emission of gaseous wastes will not increase to any significant extent as we develop the atomic power programme.

The radioactive solid wastes divide into three groups, only one of which presents a serious problem. The first contains those isotopes which are only

slightly radioactive; these are comparable to the natural radioactive elements of the earth's crust and dispersal is a satisfactory method of dealing with this group. The second group comprises the great majority of the radio-elements produced in fission and these decay fairly rapidly. Storage of these materials, for a period of say ten years, would reduce the activity to a level at which dispersal would be practicable and completely safe.

The third group is the one which presents difficulties. It consists essentially of two elements, strontium and caesium. Each of these has an isotope which decays moderately slowly so that dispersal would only be possible after an unreasonably long storage period (hundreds of years). These two isotopes are finding increasing use in industry and medicine, and it appears there will be a commercial market for all available quantities of them during the next few years. Chemical separation of these isotopes will enable the Authority not only to dispose of the first two groups without difficulty but also to market a valuable by-product.

It will, of course, be necessary to apply the same standard of radiation protection as has been adopted in the Atomic Energy Authority. By the time the supply of strontium and caesium exceeds the demand, the methods of permanent storage of these isotopes, on which work is proceeding vigorously in the Atomic Energy Authority, will have been fully worked out. The present safe procedures of sea disposal and of long-term storage may still be valuable for a small amount of certain types of high activity waste, but it is probable that newer methods will supersede them. The problems of radioactive wastes in the atomic power programme seem likely to be solved by the technological developments now in hand.

General Conclusions

The level of radioactive contamination in the world produced by all the atomic bomb explosions and peaceful atomic energy activities is at present so low that it should not cause any anxiety. The radiation level which would give rise to serious harmful effects is probably 1,000 times above the present level of contamination. We do not at present know this figure with any accuracy and long term genetic studies are required to determine it. A committee of the Medical Research Council has been formed to investigate these problems. It will in due course produce a better assessment of the position than I have been able to do today.

A.P.C.A. CONVENTION

The Air Pollution Control Association of America held its annual convention at Detroit on 22nd to 26th May. A full programme of some dozen sessions, each with several papers, was arranged. The range of subjects was wide, and we hope to receive copies of the papers and refer to them in more detail in due course.



New fume muffler being tested by the Air Pollution Foundation, California. It is claimed that the hydrocarbons in engine exhaust gases are burned completely to carbon dioxide and water in the catalytic muffler, which is the twin-box stucture at centre

A Frenchman looks at Britain's Smoke

by

Roger Valvert

We are sure our readers will be interested in this article by the London correspondent of the French economic review " Hommes et Commerce." Under the title " Foyers de Révolution " it was published in the Jan.-Feb. 1955 issue, and has been translated by the author.

THE *Daily Express* for 30th November, Churchill's 80th birthday, headlines in large capitals, above the portrait of the great man, " 80 not out, howzzat Hutton? " (80 et non éliminé, qu'en pensez-vous Hutton?)

We beg the reader's indulgence, for it is in this style and spirit that English newspapers, including the *Times*, itself, report great international contests. It is also an exact reflection of a good part of England today with its passion for sport, school of all the national virtues of which not the least (with national pride) is the affectionate respect accorded to leading men . . . When one wishes to understand a nation one must, above all, dwell on certain deep feelings which allow one to interpret its reactions in the face of any event, great or small.

In one most important field, a test case upon which we focus this letter from London, enables us to understand how revolutions are carried off in England—namely by a slow-moving evolution of public opinion. This field is that of the home, of the fireside. We refer to the fight against atmospheric pollution and particularly against " smog," that ccktail of smoke and fog, typical of London and other great industrial centres.

This " smog " is largely produced by the smoke of open fires, those fires which are made in open hearths from coal rich in volatile matter. The heavy black smoke meets a low fog ceiling and falls back upon the towns, imperilling health and buildings alike.

These fires, of course, do not heat, but this is not sought after in a country where even when it is freezing the windows of the buses are very often open and where any attempt to keep warm gives the native an insupportable feeling of guilt. One must, of course, admit that such an outlook makes for a tough people, as becomes apparent when one sees people rowing and sailing on the Thames in mid-winter despite snow, rain, wind and frost. These fires then do not heat, they burn in order to be seen in the living room by the whole family sitting down on armchairs and sofa, spread out fanwise at a distance judicially chosen so that faces are cooked and backs frozen. One and all, in silent and sober communion with the dancing spirit of the fire, stretch out comfortably beneath the draught from an open window which satisfies their insatiable desire for fresh air. For if this fire is not suitable for the feeble constitution of true continentals temporarily resident in England, it brings warmth to the English body and soul.

We should add that this national institution also permits our friends to extend their range of hobbies for besides gardening and tinkering with the old car, they are also happily encouraged to show their skill with poker and tongs, not forgetting the little brush and the dustpan which are absolutely essential items. To put the finishing touch to our description, it must be remembered that in the majority of British homes, the open

fire reigns only in the living room, for the English, a healthy and practical people, refuse to tolerate the least suspicion of heat in the bedroom or bathroom.

Like all traditions, this has an explanation. It is quite understandable that a people living on a lump of coal should have found in the heyday of Mancunian liberalism a sure method of providing a livelihood for its merchants, by wasting their merchandise.

Furthermore, in a country which was, at the time, pervaded by boredom, the flickering flames provided an outlet for the hidden flights of the imagination. In our own time, the institution has lost these " raisons d'être." But it has acquired others. Coal is scarce. One must not waste it. If then this method of heating does not heat, it teaches the English to live in what Continentals would consider cold. In consequence this waste of energy proves remarkably economical for the national and private budget. The latter, in fact, which is made very differently from ours, could not bear the cost of the tons of anthracite required for our salamanders or certain of our old stoves and central heating appliances.

The Englishman to our mind is badly fed and heated, but he has his own flat or, more often, a house, redecorated every two years, and a well kept garden. He has a bathroom even it it is arctic. To teach him efficient heating is, therefore, to risk a catastrophe.

It is quite a problem because to heat properly costs more than not to heat or to heat badly. Furthermore, if the Englishman cannot, at the moment, afford such progress, he will go to any lengths to avoid saying so. He provides self justification by inventing the devil of central heating which, lacking a visible flame, is deprived of its soul and which moreover is unhealthy, dries the throat, ruins the furniture and blackens those wall papers, which the Englishman has himself hung with so much care.

This explains why, even though the English have developed a marvellous little boiler fed with anthracite nuts or coke or very often kitchen refuse which is most efficient and economical and which heats the kitchen and provides hot water for the sink and bathroom, they cannot envisage (for they cannot afford) the idea of equipping this boiler with radiators. Likewise in blocks of flats, the central heating system hardly ever heats more than one radiator in the hall of each flat, open fires reign tyrannically everywhere else, sometimes at the very entrance to the building right in the draught where they may greet the visitor and warm the door-keeper.

Under these conditions one understands the scepticism with which the report of the Beaver Committee on " Air Pollution " published on 25th November last year was received. This Committee proposes to attack atmospheric pollution due to industrial and domestic fires; just as over 100 years ago we were forced to deal with polluted water. This matter is clearly of importance if one remembers, for example, that one " smog " alone which lasted for some days in December, 1952, was the direct cause of more than 4,000 deaths, mostly elderly people.

As far as industrial fires are concerned, the problem is only technical (it is very difficult for example to eliminate sulphur from smoke, except in vary large installations such as those at power stations) financial (special installations) administrative (levies, rebates on taxes, prohibition of shunting by steam trains in residential quarters). As far as domestic fires are concerned, a veritable revolution in manners is proposed. The Committee suggests, in essence, that coal should be replaced by solid smokeless fuels. This is very serious and what is no less serious is the question of what one can do then with millions of tons of coal for which other outlets seem very limited. In order to encourage the owners of old buildings to abandon open fires for

non-smoke producing methods of heating, the Committee recommend the removal of the 50 per cent purchase tax on electric and gas heating appliances. The question here is to know which will carry the day, tradition or civic discipline, care for the health of others and the most efficient heating with the minimum of trouble. In any case the new policy will hit the pockets as well as feelings.

It is true that some years ago, electric, gas and oil heating began to displace open fires because of greater cleanliness and economy in work. Many offices have central heating despite the objection of the employers who fortunately in this country open the windows with one accord. Well-off people appreciate the even warmth of central heating which does not exorcise from their drawing rooms the cult of the open fire with its vision-invoking flames. It is not from this, however, that the Beaver Committee receive their main support but from another revolution which is currently sweeping away many survivals from the past, television which is monopolizing fire-side life and chases away individual dreams in favour of mass entertainment as a medium for State or commercial influence . . . State or commercial television—here is yet another great battle of present day England.

What revolution in thoughts is likely to be brought about by these two revolutions in technique? Liberty or interference?—these opposed yet related principles are at stake in both. For does not the Beaver Committee interfere when recommending that new buildings should be compulsorily heated by modern central heating installations.

Without examining the sweeping changes which will result from the use of these special qualities of coal which could result for example in a disappearance of traditional coal exports (especially to France), we see that it is mainly a moral conflict which sways hearts and souls before the death throes of the open coal fire. It is a conflict between individual liberty and the State's duty to interfere in a sector of national interest.

One understands, therefore, the violent reaction of a Conservative weekly, like the *Economist*, in the face of the quiet but insupportable presumptuousness of the "planners" of the Beaver Committee. At the same time, this same Journal is not less susceptible to the need for considering the national interest. What then? We take the risk of forecasting that yet another organization within liberty is the lesson which will emerge from the solution which our friends will find for this problem of general welfare and changing habits.

At a time when our own rulers are dealing on their side of the Channel with questions of a similar nature, such as alcoholism, for example, we have every incentive to watch this experiment which is taking place among a robust and tough people who also have bad habits which are defended against attack by both economic structure and traditions.

Perhaps it would not be a bad thing to observe at the same time how a truly sporting spirit helps, if not to discover, at least to implement those measures which may prove necessary for the common good.

(We can assure M. Valvert that, provided smokeless fuels are used on it, the open fire *may* be retained. No one would dare to propose that it be banished.—Ed.)

The air of Paris will soon be as poisonous as that of London, according to municipal councillor Jacques Pecastaing. In a request to the Paris police chief for urgent measures to be taken against air pollution, he said that the smoke deprived Parisians of about one-quarter of the sun's rays. There were .3 to .4 ccs. of sulphuric acid per cubic metre of air in Paris, compared with 1.5 ccs. in London, but the proportion was increasing.



Bournemouth

Conference in September

The programme for the Society's 22nd annual conference at Bournemouth has now been virtually completed, and it is hardly necessary to emphasize that with the Beaver Report still being digested and new legislation probably on its way through Parliament, the conference may well be the most important ever held by the Society.

A new, quite informal, feature is being introduced in that on the Tuesday evening, 27th September, when delegates will for the most part have arrived, there will be a gathering at the headquarters hotel, the Grand. There will be no programme or speeches, but refreshments will be available and delegates will be invited to drop in and meet their friends.

The proceedings proper will open in the Grand Hall of the Town Hall on the morning of Wednesday, the 28th, with a civic welcome from the Mayor, after which Sir Ernest Smith will give his retiring Presidential address. In the afternoon there will be a session on recent progress in domestic heating by centralized, etc., methods. This description is called for because the purpose of the session is to discuss methods other than individual appliances—which were well covered at the Glasgow conference two years ago. Dame Vera Laughton Mathews will be in the Chair, and the papers and authors will include: Alderman C. P. Russell (Westminster City Council) and Mr. Bryan Donkin on the Churchill Gardens, Pimlico, District Heating scheme; Dr. W. Davidson on Whole-House warming (with reference, we expect, to the Heatmaster, reviewed in this issue); Dr. S. A. Burke of B.C.U.R.A. on a new system of central heating; and Mr. J. W. Moule

on electrical floor-warming and thermal storage systems.

As usual the papers will be printed and distributed in advance, and the authors will introduce them only in brief, in order to allow a maximum time for questions and discussion.

On Wednesday evening delegates will be invited to a civic reception by the Mayor of Bournemouth.

The whole of Thursday will be devoted to short papers and longer discussions on the important and comprehensive subject of "Local Authorities, the Beaver Report and the New Legislation." In the morning with Mr. F. J. Redstone as Chairman, four local government representatives will speak: Alderman C. H. Smith of Wembley Borough Council and Chairman of the South East Division of the Society; Councillor Eric Gibbons, of Brierley Hill U.D.C. and Chairman of the West Midlands Division; Dr. John Douglas, Medical Officer of Health, City of Bradford; and Mr. J. Graham, Chief Sanitary Inspector, City of Manchester.

Their contributions will be open for discussion at once, and again after lunch, when five members of the Beaver Committee will take the platform, with a sixth member, Dr. R. Lessing, as Chairman. They are Miss A. D. Boyd (Housing Manager, Rotherham C.B.); Dr. J. L. Burn (Medical Officer of Health, City of Salford); Dr. G. E. Foxwell, Mr. G. Nonhebel and Mr. C. J. Regan.

Thursday evening will be free and delegates may seek what relaxation they may feel they have earned. On the Friday morning Dr. A. Parker, Director of the Fuel Research Station, will give the Des Voeux Memorial Lecture. Dr. Parker needs no introduction, and we have no doubts that the lecture, on "The Destructive effects of Air Pollution on Materials" will be an authoritative review of one of the most important aspects of the pollution problem. We are already looking forward to its subsequent uses.

Finally, there will be the A.G.M., at which the retiring President will hand over the badge of office to his successor. As already announced, Lord Horder has agreed to accept nomination on behalf of the Executive Council, and he has kindly undertaken, not to make a Presidential address, but at least to say a little more than the customary "few words" of acceptance.

C.U.C. CONFERENCE

The Coal Utilization Council held a two-day conference at Eastbourne on 18th and 19th April. With an address by Sir Hugh Beaver on the air pollution situation, and a paper by Dr. Harold Hartley on "Domestic Solid Fuel Appliance Design and the Beaver Report," there was a considerable emphasis from the platform on the part to be played by solid fuel in the promotion of clean air. Nevertheless there were signs that the enthusiasm of the body of the meeting for the changes that are necessary is not yet as whole-hearted as it might be. Thus one speaker declared, with a murmur of approval from the audience, that we must consider the health of the people and that "clean air might not be so good for health as the open fire."

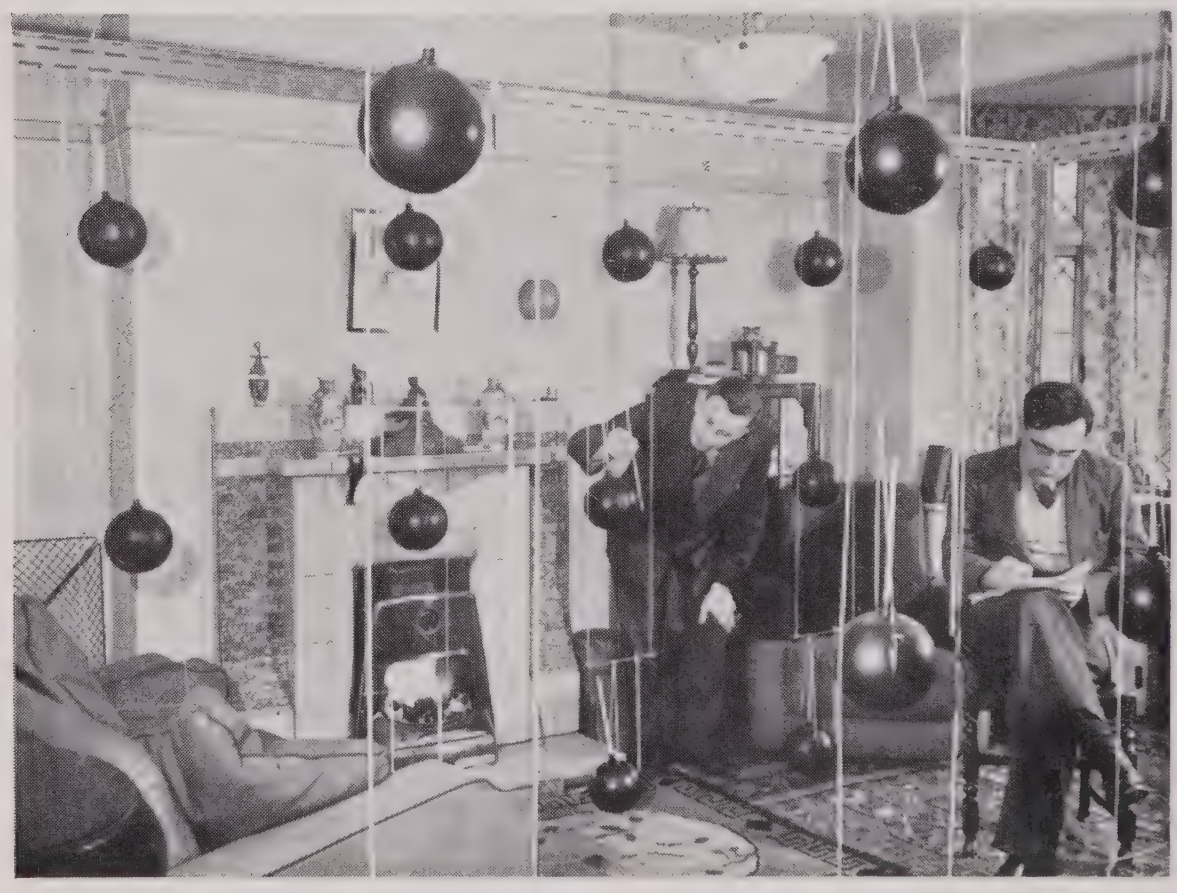
"Unimaginable Squalor"

"I have been abroad for nearly two years. Returning to London from other cities I have had occasion to visit—Hong-Kong, Paris, Yokohama, Tokio—my full overwhelming impression is one of filth. To a citizen of Singapore, as I am. London presents a spectacle of almost unimaginable squalor. I dare not assert that London is the dirtiest city in the world, for I have not seen them all."—*Professor C. Northcote Parkinson*, writing in the *Glasgow Evening Times*.

SMOKELESS ZONE NEWS

Twenty areas in **Bradford** were declared smokeless zones on 1st April. About 1,500 acres are involved, with more than 11,000 premises and dwellings. The **Salford** smokeless zone orders, which were delayed on the original date of 1st January, came into operation on 1st May. The **City of London** will become a smokeless area on 2nd October. An advisory bureau, for the guidance of persons having to make conversions, is to be opened during the summer.

It is expected that **Birmingham's** first two smokeless zones will be in operation early in 1956. **Edinburgh** may have a smokeless zone in its western suburbs. A recommendation before the health committee has been referred to the City Architect for a report. The establishment of smokeless zones in **York** is under consideration, following a resolution of the Yorkshire Division of the Society. **Nottingham's** health committee has announced plans to make the city centre an initial smokeless zone of 170 acres. The L.C.C. is considering a suggestion from **Camberwell** that the Picton street slum clearance area be made a smokeless zone.



This unusual photograph illustrates, not preparations for a party, but tests being carried out by B.C.U.R.A. on living room comfort conditions with new types of fire (*See also page* 206). *The black spheres are "globe thermometers," and measure a temperature that can be used to assess comfort*

*The Archaic Steam Locomotive**

The Case for Electrification

by

G. H. Rawcliffe

Professor of Electrical Engineering, Bristol University

IN 1931 the Weir Committee reported that the total electrification of Britain's railways was very desirable, but the only area where large progress was made before 1939 was the area of dense suburban traffic served by the Southern Railway The thirties—that period when Britain seemed unable to bring together idle hands and undone work—passed, while the railway system gradually became more old-fashioned in relation to mechanical progress in other spheres. The war imposed an enormous strain on the railway system and reduced the attention given to its upkeep; and finally the post-war fuel shortage and railway strikes have made it apparent to all that new measures are needed. The British Transport Commission proposes to build no more express steam locomotives after the 1956 programme and is, on paper at least, committed to substantial electrification.

Fuel and Power

About fourteen million tons of best-quality coal are used annually by the railways, whereas about four million tons of indifferent coal would generate all the electricity needed to do the same work. Quite apart from a substantial saving in cost, the actual saving of coal is important, for it has to be remembered that coal supplies (especially good coal supplies) will run out in a few generations, and that coal is not only a fuel but is also the source of valuable chemicals, which are wholly lost by open combustion.

It is unfortunate, in some senses, that "fuel" and "power" have become bracketed for administrative purposes, because they have thus become bracketed in logic in the public mind. In fact, it would hardly be possible to find two subjects for discussion for which such divergent considerations and arguments are valid. The peasant whom Good King Wenceslas saw gathering winter fuel was only concerned with keeping himself warm; and it is at least open to argument whether electricity is the ideal fuel, in all circumstances, for the purpose which the peasant had in mind; in modern parlance, for space heating. But in relation to power, and in particular to rail tractive power, the matter is simply not open to discussion when the issues are understood aright. Electricity is the answer, and the steam locomotive is an anachronism: it is a legacy from the days of cheap and apparently unlimited high-grade coal, which it burns at, say, 5 per cent overall efficiency, as compared with a power station which will burn coal of the most indifferent quality at about four times this efficiency.

Ninety-five per cent, or thereabouts, of the heat in a locomotive boiler is scattered on the surrounding countryside: a truly staggering thought. Even this comparison is probably unduly favourable, because a steam locomotive still uses coal when waiting in a station or a siding, or when braking at a station approach. An electric locomotive uses only the power it really needs; and indeed, in some systems, returns its energy of motion to the mains while slowing down. Every increase in the mean thermal efficiency of electric power generation —and the figure is steadily rising—is

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On the new Manchester-Sheffield Electrified Line
The Up Continental Boat Train

one more argument for railway electrification.

There are those who think that atomic energy will provide a substantial part of the nation's power needs in the relatively early future, If they are right, this reinforces the argument for electrification, since the only way in which atomic energy can be used is to turn it into heat in an atomic boiler, and thus into electricity by means of a steam turbine and electric generator. If they are wrong, there is all the stronger argument for conserving coal; and, whether one is sanguine or sceptical about the probable date and magnitude of the contribution to national power resources to be made by atomic energy, the argument about electrification runs all the same way. It is remotely conceivable that " pocket " atomic power stations will one day be economically possible, or even that some method of directly transforming atomic energy into electrical energy will be discovered. The most that can be said is that these are much farther ahead than the atomic boiler for major power stations, and cannot be considered as even on the fringe of national scientific policy. For the moment, total electrification of the nation is the appropriate response to atomic energy.

Emotion, Science and Dirt

If it were possible to teach the basic laws of science as part of the general education of everyone, national feeling on technical issues would be very different. It can only be ignorance of the laws of thermodynamics which has kept the reciprocating engine acceptably alive in the public mind; and, indeed, the " puff-puff " is the first piece of mechanism in which nearly every child is encouraged to be interested, and towards which an almost emotional attachment commonly arises. Men in high professional positions quite divorced from engineering are often found to be knowledgeable about locomotives; and an irrational public attachment to the steam locomotive has contributed not a little to the official ignorance of its extreme inefficiency, and to tolerance of its filth.

In truth, the " puff-puff " of a steam locomotive might be described as the jet of a moving smoke-blasting machine, and no one who considers the dirt which is impelled on to the greater English cities by locomotives entering them through narrow cuttings, where wind dispersal is impossible, can really advocate the continuance of such a state of affairs. The climax of railway pollution can per-



Freight train with Bo-Bo electric locomotive approaching Torside Crossing

haps be seen in Liverpool when the train leaving Lime Street Station " puffs " uphill for the best part of a mile through a cutting half roofed-in and half open.

Apart from the economic and efficient use of coal, and from its conservation as a natural resource, almost all the conditions which favour railway electrification are found concentrated in Britain. While we have not to cross heights like the mountains of Central Europe, we have at least many very considerable gradients and many long tunnels. We have large areas of concentrated suburban traffic, needing a rapid service yet with many starts and stops on the way. We have large areas where smoke pollution is a menace; and, over much of the country, goods and passenger traffic are intermingled. Electricity is supreme in flexibility, giving virtually unlimited power for acceleration, braking, or climbing on the touch of a handle; and alike in tunnels and urban areas its cleanliness is of the utmost advantage. The Weir Committee thought that the biggest savings resulting from electrification would be the reduction in maintenance, and the greater effectiveness of the locomotive crews, who would need no stoking-up time, cleaning time, and the like, but even further savings would result from reduced painting and cleaning of stations and carriages.

Some types of power drive produce uniformly distributed operating forces, maintained steady all the time, without impacts, and these machines last the longest time with the least maintenance and give the smoothest operation throughout their lifetime. These are truisms to any trained engineer; and, on this basis, the most perfect existing machines are the steam turbine and the electric generator and motor.

There can be only one rival to railway electrification, the diesel rail-car, and that for less-used lines only. Deisel engines are high-compression engines, operating in effect by recurrent explosions; and the maintenance required is necessarily greater than that for electrical machinery; and the noise, smell, fuss and jerky action of diesel rail-cars are unknown in an electric train. Though the full-load thermal efficiency of a diesel may be even higher than that of a turbine, this is not maintained over a day's duty, as is the efficiency of a turbine. There is something inherently illogical in carrying one's source of power about with one, instead of drawing limitless power from a wire; and no gear-box can compete with an infinitely variable electric torque. Diesel

cars may be a cheap alternative to electrification, but they are certainly a less agreeable one; and if a railway line is worth running it is worth electrification.

There is, of course, a half-way house in the diesel-electric system of traction in which a diesel-driven electric generator, carried on board the locomotive, supplies power to an electric motor drive. This, obviously, has most of the advantages of full electrification but is necessarily more expensive than a diesel engine with mechanical transmission. Economic considerations may sometimes dictate the use of diesel-electric traction for intermittent service in rural areas, but total electrification is to be preferred wherever possible.

The argument that railway electrification is too expensive and that Britain cannot afford the capital investment involved, is much weakened when the experience of Continental countries is considered. Austria and Hungary in the inter-war period were truncated and uneconomic units, if ever there were such, but railway electrification was carried through—as in other parts of devastated Europe—to completion. France, since the last war, has responded to her crippled condition and economic difficulties by pushing ahead with general electrification, including the railways. The truth is that it is the poorer countries which have been driven by their economic straitness to develop their resources with the greatest efficiency and that means electrification. Only those who are rich enough to afford "penny-wise-pound-foolish" economics ought to consider the retention of the steam locomotive and its prodigal waste. If we do not take courage totally to electrify now, whilst our transport and economic position is difficult, we may be forced to do so later when it is critical. Is Britain really too poor to afford what many smaller countries have long ago taken for granted?

FIELD TESTS ON NEW FREE-STANDING CONVECTOR FIRES WITH RESTRICTED THROATS

A report is published in the March issue of the Journal of The Institute of Fuel on field tests by the Domestic Appliances Laboratories of the British Coal Utilization Research Association which were undertaken to compare the performance of free-standing open fires with restricted throats with ordinary open fires, under conditions of normal domestic operation. The results were obtained from a group of 39 households, all having living rooms in the same medium-size range. Twenty-seven of these used their own open fires during the first period of the test and were equipped with one of the two free-standing convector fires during the second period. The remainder used open fires throughout the test, and acted as a control group.

In addition to the measurements to obtain records of fuel consumption and inside air temperatures in the 39 households, more detailed explorations of temperature were undertaken in eight living rooms of the houses used in the tests while they were in use by the families, to compare the distribution and quality of warmth, during the evening period. These measurements were extended in the case of one unoccupied but furnished living room, to tests lasting 10 hours, in which the appliances were compared during days of equal outside temperature.

The results indicated that the free-standing convector fires resulted in a fuel saving of approximately 21 per cent, although they were operated for longer periods and were used to maintain higher levels of comfort. The measurements of warmth confirmed these results, and from both the evening and the 10-hour tests it is possible to infer that the free-standing fires are of the order of 60 per cent better than the open fire when judged on the basis of area of warmth per unit burning rate.

NEWS

Sir Hugh Beaver's Calvin Rice Lecture to the American Society of Mechanical Engineers at New York on 1st March was entitled "Air Pollution—the Growth of Public Opinion." He reviewed the history of the problem in Britain, the position during the nineteenth century, the Newton Committee and its report, and then the events that led to the establishment of the committee of which he was chairman. Sir Hugh concluded by saying that he did not believe that their recommendations would have had the slightest chance of being accepted either by Government or industry or by the ordinary householder or by the public press, twenty years ago, or perhaps even five years ago. Now, he believed, the odds were quite strong that action would follow. "At last there has been that growth of public opinion on which everything in the end rests."

★

The theme of the British Electrical Power Convention to be held at Brighton from 27th June to 1st July will be "Electricity and the Future." Of special interest to our readers will be a session on electricity and the industrial future, with papers on the use of electricity in the steel industry, the coal industry, the chemical industry and the catering industry.

★

Smoke abatement exhibitions organized by local authorities have been held recently at Wanstead and Woodford, and at Barking. Dame Vera Laughton Mathews, a Past President of the Society, addressed a meeting at Barking in connection with the exhibition. Coke, she said, was the only economical solution to the problem of air pollution. Councillor Mrs. Engwell, proposing a vote of thanks to Dame Vera, declared that "a smoky traditional fire is an evil we have to abolish."

Pilot plant experiments are being started at the North Wilford, Nottingham, power station with a new flue-gas washing process which not only extracts 90 per cent of the sulphur in the gases but also, for the first time, will give usable products—ammonium sulphate and pure sulphur. Unlike other processes, it is hoped that it will either nearly pay for itself or even give a small profit. The plant operates on the Fulham-Simon-Carves principle, and will wash half the flue gases from one of the station's 12 boilers. It will use daily about 10 tons of gas liquor brought from two Nottingham gasworks, and will each day produce about half a ton of sulphur, and $5\frac{3}{4}$ tons of ammonium sulphate.

★

The 15th April issue of *Iron and Coal Trades Review* contains an article that will be of interest to readers in certain industrial areas. It is a survey of "Grit Deposition from an Integrated Steelworks," by H. G. Jones, Manager of the Operational Research Department of the Steel Company of Wales.

★

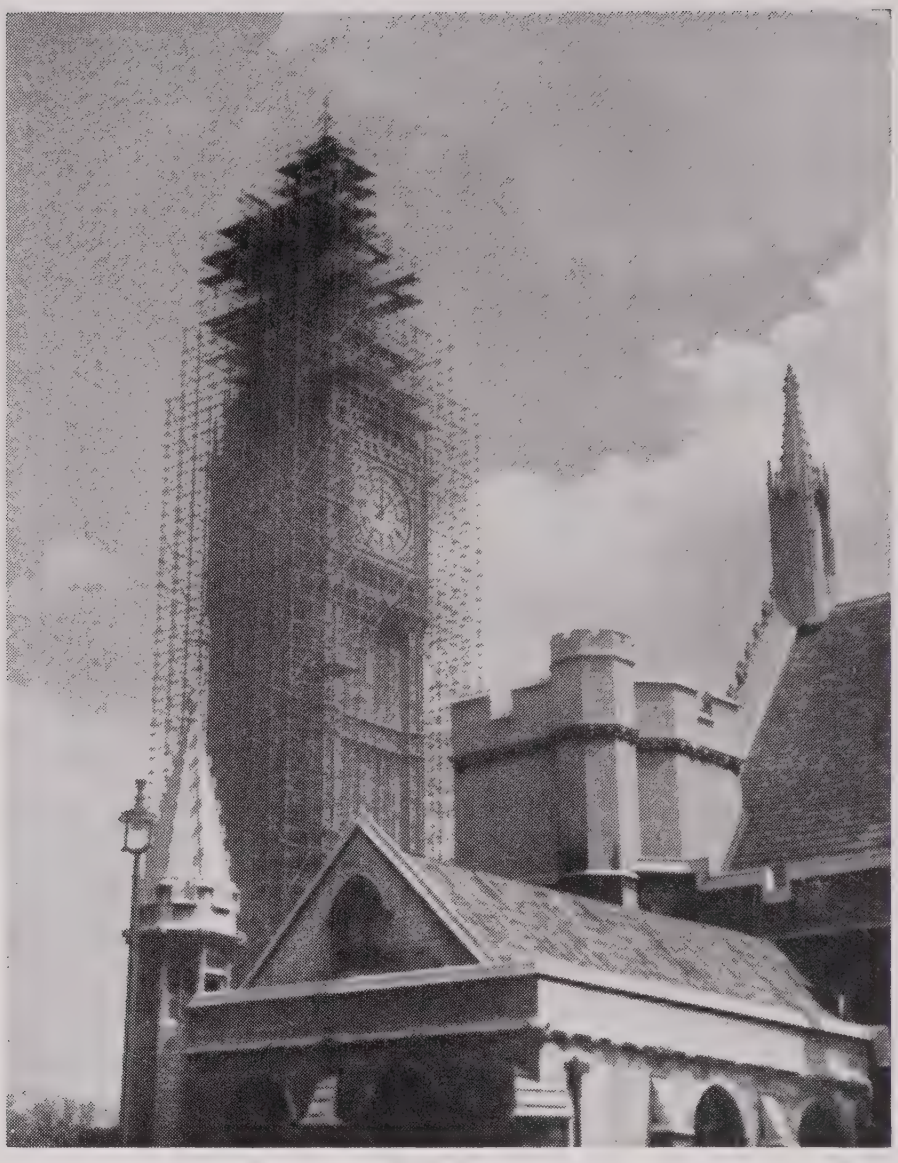
The Coal Utilization Council is considering a scheme of what they have called "mobile smog squads," to go into smokeless zones to help people to adjust themselves to new conditions.

★

A smoke abatement Bill has been introduced before the Hong-Kong Legislative Council. It is designed specifically to improve visibility conditions around the Hong Kong airport. The smoke from nearby factories is said to endanger air navigation.

★

The Co-operative Party conference at Scarborough during Easter passed unanimously a resolution urging the Government to implement the Beaver Committee proposals for reducing air pollution and supporting the principle of smokeless zones. The resolution advocated provision of appropriate appliances and an adequate supply of smokeless fuel at reasonable prices.



The Dissolution of Parliament, 1955

(*It was estimated, before the last war, that the cost of repairing the Houses of Parliament would be at least a million pounds*)

N.S.A.S. YEAR BOOK, 1955

The Society's *Year Book* for 1955 has now been published. It contains not only information about the Society—annual report, accounts, subscription list, officers and Council, particulars of membership and services, etc.,—but a general section of up-to-date information and data that will be of use to all concerned with the problem. This section includes articles on the law, recent local legislation, the work of Government departments and other organizations, excerpts from the Beaver and other recent official reports. The price is 1s., by post, 1s. 2d.

Publications Received

A considerable number of interesting publications have been received recently by the Society, many of them from the American Continent. The *1954 Report to the Air Pollution Advisory Board of the City of Toronto* indicates that the importance of the problem is becoming widely recognised in Canada. Some interesting statistics are quoted, and present difficulties are outlined. *The Division of Smoke Regulation and Inspection for the City of Columbus, Ohio*, have sent a comprehensive report on progress during 1954. City byelaws now make it essential for all those who install fuel-burning equipment to be licensed by the City authorities. There are interesting sections on the periodical inspection service run by the Division, and on " Public Relations."

The 1954 Report of the City of Pittsburgh Bureau of Smoke Prevention is a valuable indication of the amount of improvement attainable. The Report contains a useful summary of the smoke laws relating to the City of Pittsburgh, and some good comparative photographs. Statistics for " Hours of Moderate Smoke " and " Hours of Heavy Smoke " are quoted for each year since 1946. The total number of hours of moderate and heavy smoke has fallen from 1,005 in 1946, to 143 in 1954, i.e. by 86 per cent. From California comes a report by the *Stanford Research Institute—The Smog Problem in Los Angeles County*— and several Conference reports and news-sheets issued by the Air Pollution Foundation. The Stanford Research Institute's Report is well produced, and copiously illustrated. The Los Angeles problem is not one of smoke-pollution, although large quantities of gaseous and liquid fuels are burnt by the public, commerce, and industry. The special conditions seem to be that the mountains surrounding the basin cause characteristic weather patterns, resulting in atmospheric stagnation, and this, combined with the unusually large proportions of ozone present in the air, is responsible for the oxidation of organic materials given off during combustion. The Report examines this problem, discusses the research which has already been carried out and illustrates the physiological and biological effects of smog.

A Report which supplements the above is *Report No. 2, " Combustion and Smog,"* issued by the *Southern California Air Pollution Foundation.* This well-documented volume considers the relation between combustion processes and the Los Angeles phenomenon. There are useful chapters on the composition of exhaust gases from petrol engines and diesel engines. The same Foundation has also produced a *Summary of the Conference on Incineration, Rubbish Disposal, and Air Pollution.* The advantages and disadvantages of incineration as a method of rubbish disposal are considered, and representatives of several American cities outline the difficulties of rubbish disposal in metropolitan areas. Several other valuable papers, which cannot be reviewed in detail, have been received from the same source.

Nearer home, mention must be made of the excellent *Conference issue of The Sanitarian*, containing two excellent papers on air pollution. The pictures of the Clifton housing, together with the accompanying paper by Mr. Alfred Wade, are of especial interest. The *Federation of British Industries* has given good value for five shillings in the *1955 edition of the " Fuel Economy Review,"* There are interesting articles on " The Sampling and Analysis of saleable coal," " Solid Fuel Purchasing," and " The Origin and Evolution of Coal." Like all the publications of the *British Iron and Steel Federation, the Annual Report for 1954* is well supported with statistical material. The contents

(*Concluded on page 211*)

THE HEATMASTER

A New All-Purpose Appliance

The "whole-house warming" system introduced by Radiation Ltd., is now widely known. In this the house is warmed by ducted air supplied from a single appliance, which may be operated by solid fuel, gas or oil.

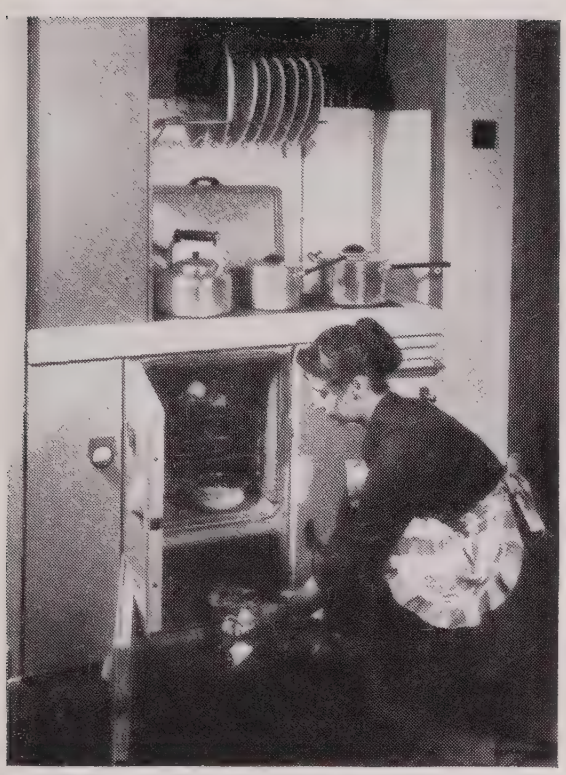
A combination appliance, the "Heatmaster" has now been developed by the same firm. The one unit combines house-warming, hot water supply and cooking. After full laboratory development and testing the first models have been installed in a group of maisonette flats over shops in the central area of Coventry, and have been tested in use during the past winter. The installations were recently demonstrated to the Press.

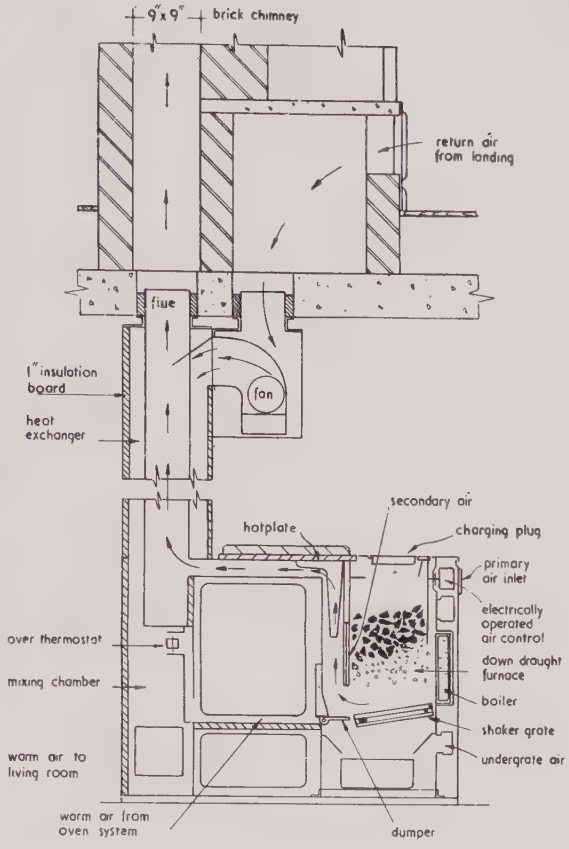
The photographs show the Heatmaster as installed, and the diagram illustrates its construction in section. It is a free-standing, insulated unit comprising a small furnace and boiler, with a heat exchanger, fan and motor, and a thermostatically controlled cooker. The appliance will burn solid smokeless fuel of all types or bituminous coal. When burning smokeless fuel the firebox operates on the normal up-draught principle, and on down-draught when burning coal. This, with the introduction of secondary air, ensures that the coal is burned with virtual smokelessness—it is claimed that no more smoke is emitted than from a semi-coke.

A room thermostat, warm air outlet and return air ducts and register complete the installation. Cooking and hot water heating can be operated



The Heatmaster as installed at Coventry





A closer view of the Heatmaster. Right: a section through the appliance

independently of room heating; full hotplate, oven and extra slow-burning oven facilities being provided for six to eight persons. One of the interesting features is, of course, the thermostatic control of the oven. It is believed that this is the first solid-fuel cooker to be so equipped to cover the whole range of oven temperatures as closely as do the thermostats on gas or electric cookers.

The four manual operations involved are: (*a*) setting the room thermostat, (*b*) setting the oven thermostat, (*c*) cleaning the oven bed, and (*d*) refuelling (once in 24 hours in summer conditions, usually twice in winter).

The Coventry field tests have shown that the three services can be provided in the coldest weather for a weekly outlay of 12s. 6d., with coal at 109s. per ton and coke at 120s. This is about half the cost of providing services of a similar standard with conventional appliances.

The appliance, it need hardly be said, is well designed and finished, with attention being given to all the details of practical operation and maintenance that are so important. It is of considerable interest for its potentialities in new housing—especially in the smokeless zones and smoke-control areas. Fuller details can be obtained from Radiation Group Sales Ltd., Solid Fuel Division, Armley, Leeds, 12.

New York University is offering, for the second year, a course in air pollution. This year's course will meet once a week for 15 weeks.

PUBLICATIONS—*concluded*

vary from a brief report on the Federation's work on the reduction of air pollution by steel manufacturers to an exposition of recent development of the European Coal and Steel Community. Another Annual Report whose contents are equally varied is that issued by the *British Electrical and Allied Manufacturers' Association.* It will repay attention by all connected with the electricity industry.

Smoke and Sulphur

Attacks on Smokeless Fuels

AN opinion about air pollution that has recently been expressed in certain medical and political circles calls for examination, for if it were more widely accepted it could do considerable harm to the progress towards clean air that now may be hoped for.

The Socialist Medical Association, under the chairmanship of Dr. Somerville Hastings, M.P., criticized the Beaver Report on the grounds that the prevention of smoke "will do little to prevent the occurrence of disasters such as that of December, 1952, because the problem of sulphur gases has not been tackled in a way guaranteed to diminish its intensity in large cities, especially London."

This might be accepted as a fair criticism, although the reason the Beaver Committee did not go further in proposing remedies for the elimination of sulphur pollution was no doubt simply that, unfortunately, no such remedies at present exist. The Association themselves have no practical proposals to offer, other perhaps than the washing of flue gases from power stations, which constitute only a small fraction of the problem.

Dr. Hastings developed the argument in an article in the *Spectator* of 19th November, 1954, where he stated that "the real trouble in fog is the sulphur oxides poured out into the atmosphere by the combustion of all types of solid and liquid fuel, except wood," and that some destruction, though less severe, must be going on all the time. He asked what could be done, and said:

> "Bad stoking of domestic or factory fires may increase the amount of smoke and grit in the atmosphere, but has no effect on the dangerous sulphur fumes. It used to be said that if only people would make use of slow combustion stoves or burn exclusively coke or smokeless fuels all would be well. This is pure nonsense, for just as much sulphur in the form of dioxide and trioxide is given off from these as from coal."

The remedies are that:

> "We must not only get rid of all stationary fires that produce sulphur oxides but coal and oil burning locomotives as well and replace steam by electric power in and near towns. . . . Much research remains to be done, but one thing is certain—the problem will never be solved by a childlike faith in smokeless fuels and smokeless zones."

Mr. Arthur Skeffington, M.P., as reported in the *Hayes Gazette* of 19th November, 1954, developed the attack on smokeless fuels by declaring:

> "We must be careful when using smokeless fuels. While they may not give off much grit they will give off sulphur dioxide and this is a real killer. Most of the people who died in London's 'killer smog' two years ago were probably killed by sulphur dioxide fumes, more of which are given off by smokeless fuels than by coal."

This item of news appeared under the headline: "Smokeless Fuel can be a 'Real Killer'."

Next, the journal of the Medical Practitioners' Union, *Medical World*, discussing the Beaver Report in its January, 1955, issue, stated:

> "Too much emphasis is placed on the benefit to be obtained from smokeless fuel and too little is said about the sulphur content of such fuels. In most cases this is as high as, or higher than, that of ordinary coal, and their use will do little to abate the crippling effects of a sulphur-laden, damp atmosphere. Vested interests are growing

up in the production of these fuels and dispassionate assessment of their value is becoming difficult in a press which carries many advertisements extolling their virtues."

And then, under the headline: " Smog causing more Cancer. Smokeless Fuels won't do good," the *Hampstead Express* of 18th March, 1955, reported Dr. Samuel Leff, Medical Officer of Health for Willesden as having said at a meeting in Chalk Farm: " Don't put too much faith in smokeless zones and fuels. They produce sulphur dioxide as much as ordinary coal—with the same degree of danger." Also, said the report, he told the meeting that " large vested interests are behind the ' plugging ' of smokeless fuels and grates in the fight against smog," and that " the National Smoke Abatement Society gets a lot of money from organizations interested in smokeless fuel."

(This last remark, echoing a similar statement by Dr. Hastings in the House of Commons, is referred to in our editorial comments.)

The Argument Examined

No one is going to dispute the seriousness of sulphur compounds as part of the air pollution from which we suffer or to agree that their elimination would not be valuable, but what must be strongly refuted are the inferences that these compounds are all that matter and that until they can be removed we can and need do nothing to try to improve the state of the atmosphere. Arguments of this kind can only come from an incomplete understanding of the facts of the problem and a failure to understand the *processes* (in a political, public-acceptance sense) through which progress has to be made. It is not uncommon for idealistic or perfectionist views to do more than straight opposition to thwart and delay more realistic action.

The facts of the case, expressed as concisely as possible, may be stated as follows.

The principle constituents of general urban pollution in this country are (*a*) the particulate and visible emission composed of sooty, tarry and oily particles or droplets together with mineral grit and ash particles; and (*b*) the invisible gases, principally sulphur dioxide, with a little sulphur trioxide, dissolving in moisture to sulphurous and sulphuric acid. There are smaller quantities of other pollutants, some of which may have an importance not yet recognized.

The effects of the different constituents may be regarded as (i) the direct effect of each, acting as it would act if entirely isolated from the others; and (ii) the effects of two or more of the constituents acting in association with each other, as a complex.

That the smoke and sulphur especially do act as a complex is well-established. Sulphur may be the chemically active factor, but the smoke and grit particles act as carriers, and possibly as catalysts, and also in fog behave as nuclei on which moisture condenses to form droplets in which the acids may dissolve. Thus the erosion of stonework under the adhesive acid-bearing deposits is one example of conjoint action, and even more striking is the marked acceleration in the corrosion of iron in the presence of carbonaceous particles, as demonstrated by Vernon. Physiologically, synergistic action between smoke particles and sulphur is very probable, both during fog and under normal urban conditions.

Even if, during fog, the smoke played no part whatsoever in the direct physiological actions that have such disastrous effects, it is the smoke that creates the black smog which, by blanketing solar radiation keeps the temperature down and extends the period over which the fog may persist.

The elimination of smoke and grit will therefore materially lessen the ill-effects of sulphur, and on this account alone might be well worth while. What, however, the critics surprisingly overlook is of course the

serious nature of the visible pollution, on health and in numerous other ways, quite apart from and independent of the influence of sulphur.

Smoke and Health

On health grounds alone smoke stands condemned for the obstruction of sunlight, including diffused daylight and ultra-violet radiation. In some areas this may reach two-thirds of the available light. It was this loss of light that the Registrar-General, in his evidence to the Barlow Commission, considered to be one of the main factors responsible for the excess of urban over rural deaths in this country. The influence of coal smoke upon the incidence of lung cancer may not yet be conclusively proved, but it is in the smoke—and especially domestic smoke—that the carcinogen benzpyrene is to be found. It is also the visible smoke and its deposits that create the squalor and drabness that is so prominent a feature of our grimy cities and which has its own subtle effects on mental health.

On the economic side it is the smoke and grit alone, or the sulphur-smoke complex, that is responsible for a large proportion of the £250 millions a year cost of pollution. But these points need not be laboured, in this journal especially: they are familiar to anyone who has studied the problem.

A further assumption in the argument being discussed is that the amount of sulphur emitted into the atmosphere will be the same in smokeless zones—and smokeless towns—as now. This is not the case: the change to smokeless methods will in part be met by solid smokeless fuels and to some extent by oil, in part by gas and electricity, and, in part by the smokeless combustion of bituminous coal. Thanks mainly to the increased use of gas and electricity there will be a reduction in the overall emission of sulphur even if there were no reduction in the thermal value of the fuels used. The new methods will, however, give a higher efficiency in use, which means a lower consumption of fuel and thus a further reduction in the quantity of sulphur emitted.

Thus, in summary, the progress towards clean air by a policy that has long been advocated by the N.S.A.S. and which has now been authoritatively confirmed and developed by the Beaver Committee, *and which can be begun at once*, will mean:

1. A reduction in the net amount of sulphur emitted.
2. The elimination of the many harmful effects of pollution due to smoke and grit alone.
3. The elimination of the harmful effects of pollution due to the association of sulphur gases and smoke.

All that remains is the harm done by the remaining sulphur gases in isolation. Dr. Hastings and his friends contend, or imply, that this one factor is the only one of importance—that the rest do not matter and that it is childlike to think that they do.

How serious the isolated sulphur gases are we do not know, for until we have created smokeless zones of considerable size we cannot make any practical observations; but it as plain as a pikestaff that this one factor cannot be as serious as the whole of which it is one component part. There is no doubt plenty of sulphur gases still being emitted into the air of places like St. Louis and Pittsburgh, but we have not heard of any disappointment that the great efforts made to prevent smoke have not been worth while. On the contrary.

The critics appear to be thinking only in terms of the sensational, but fortunately rare, smog, and not of the ordinary or " normal " air pollution problem, which, insidious though it is, is in fact far more serious. In respect of smog alone, there may be one point of substance underlying their argument. In dense fog, with a very low inversion ceiling, any combustion could become dangerous, with or without sulphur oxides. Carbon monoxide, aldehydes and other hydrocarbons, metallic salts (stated recently

in the U.S.A as likely to be the key factor in both the Donora and London smog episodes) and possibly other agents may, singly or synergistically, produce injurious results. If this is the case the only safe thing would be to prohibit all combustion, including that from transport, and to rely for heat and power entirely on electricity generated outside the affected areas. The technical and economic difficulties of such an ideal scheme would be enormous, even if it could be achieved, and at present it would seem to be outside all practical politics.

If we could make immediate progress towards the elimination of the sulphur from the fuels we of necessity must use, or if we could at least prevent its emission into the atmosphere, this Society would be among the first to press for action. But the plain fact is that there is as yet no practical solution, except in the case of large power stations which are responsible for only one-fifth of the total sulphur emitted, and probably a much smaller fraction of the sulphur that actually does harm. To hold up the elimination of smoke and grit until such time as we can also eliminate sulphur would be the negation of a clean air policy. If the position were reversed, and it was possible to eliminate sulphur but not smoke, the correct approach would remain the same: press on with what is possible and tackle the other as soon as we can. Air pollution has been—and in all probability will continue to be—such an obstinate problem that we must take advantage of every opportunity for improvement, all along the line, whether it is wholly or only partially effective.

Moreover—and we would like to emphasize this—the research and developments that will have to be undertaken before the elimination of sulphur gases and other harmful substances can be demanded are not likely to be attained, and their cost accepted, until public opinion demands them more forcefully. And such an advance in public opinion can best be obtained by pressing on now with the Beaver programme, so that as progress is made there may be, as it is certain there will be, a steady rise in public standards of air cleanliness.

To brush aside smoke prevention as of being no importance is more than likely to put further into the future the day when the other problems can be successfully tackled. The arguments that have been discussed, if persisted in, could prolong the apathy and defeatism that has for so long been the major obstacle to clean air, and which only now is beginning to break down.

Correspondence

THE HEALTH ASPECT OF AIR POLLUTION

To the Editor,
" Smokeless Air."

Sir—There seems to be a general impression that when we have a catastrophe such as occurred lately in London or that in Donora that the cause of deaths was due to sulphur dioxide in the air. Many assume that SO_2 becomes SO_3 and then in contact with moisture turns into sulphuric acid.

Many doctors disagree with this. They say that 4,000 deaths could not come from sulphur alone and other toxic agents must have been present. The only record we have is the SO_2 determined during the London fog. No other determinations of toxic materials were made during the fog except possibly some CO which was due to concentration of automobiles and did not cover the general area.

Why do we assume it is sulphur? Chiefly because we can taste it, smell it and it irritates our throat. What about oxides of nitrogen? These can neither be tasted, smelled or seen. We do not know when we breathe them and they are extremely dangerous. The same with cadmium, antimony and many other very toxic

agents.

In the February, 1954, issue of *Public Health* published by the American Public Health Association is an article written by Dr. Frank Princi on the Health Aspects of Atmospheric Pollution. He says: " A critical examination of the various investigations including the London fog records shows that neither the postulate of synergistic activity nor the theory of pulmonary irritation have as yet been demonstrated."

As Dr. Princi further says, many toxic materials may be absorbed by our respiratory tracts and exert their effects on the other organs, yet death may be registered as cardio-respiratory. In other words, sulphur may be present and produce irritation and yet not be the cause of death. This means that in the present state of our knowledge we need information on air pollutants.

For example, do we know that carbon smoke is harmful? It is a nuisance, yes; but it is not proved that smoke affects our respiratory system. Does it produce catarrh? The doctors disagree.

The late Dr. Samuel R. Haythorn, many years in charge of the laboratory work of the Allegheny General Hospital in Pittsburgh, made a study based on some 2,500 post-mortem examinations of lungs. In his published records he states his conclusion that the carbon does not predispose to tuberculosis. Further information goes with this, viz.: to do damage, particles such as silica, for instance, must be between 1 and 10 microns in size and that the weight of the particle or its shape has nothing to do with it. The action is entirely chemical and not physical.

It is true that we have some published data (how reliable, I do not know) of certain elements and compounds giving the amount that taken into the human system are dangerous. But how about small quantities? Can a man live in them indefinitely? Men working about sulphuric acid vats, some die young, some do not. Are such deaths caused by prolonged exposure to small quantities of breathed in acid vapours? What accurate information has the physician got about the effects of dusts? Perhaps something about silica. How about nickel, copper or even iron ore dust? What is the lower danger limit? And what effect does the size of the particle have? We need more information, more investigation.

Yours, etc.,
SUMNER B. ELY,
Superintendent, Bureau of Smoke Prevention.
Pittsburgh, Pa., U.S.A.

THE SURPRISING CITY

To the Editor,
" Smokeless Air,"

Sir—I travelled by train last week to Manchester. As we reached the suburbs, the sky grew dark and the atmosphere more murky. I thought to myself, " Oh dear, the same old dirty Manchester! "

With friends who met me I hurried out of the gloomy London Road station. To my astonishment I found myself in clear air under a bright sky. My friends, noticing my bewilderment, hastened to say " this is Manchester's smokeless zone."

Of course, as a member of the N.S.A.S. Council, I really ought to have been on the look out for it, but what a pleasant surprise!

Yours, etc.,
LESLIE HARDERN.
Public Relations Officer,
North Thames Gas Board.

A suggestion for a clean air campaign to combat smoke pollution in Spen Valley was made by Mr. F. T. Sobey at the annual meeting of the Spen Valley Chamber of Commerce in Cleckheaton. He said that districts such as theirs were losing £10 per head through smoke each year, and looking round the district it was easy to see where some of the money went. He regarded the proposed new measures as " anaemic and lukewarm."



From our Photo-Library—22 *Picture Post*

Smoke on the Road

(*This photograph was used to illustrate the* Picture Post *article, "A Killer in the Streets?" by John Stobbs, in the 19th March, 1955, issue*)

"Wherein Neether Herbe nor Tree will long Prosper . . ."

We are indebted to Mr. Charles H. Curtis, V.M.H., writing in *Amateur Gardening* for a quotation from a work published in 1629 by John Parkinson, with the title *Paradisi in Sole Paradisus Terrestris.* Describing the best place in which to have a garden, Parkinson advised that it should not be near "any common Lay-stalles, or common Sewers, or else neare any great Brew-house, Dye-house, or any other place where there is much smoake, whether it be of straw, wood, or especially sea-coales, which of all other is the worst as our City of London can give proofe sufficient, wherein neether herbe nor tree will long prosper, nor hath done ever since the use of sea-coales beginneth to be frequent therein."

Cardiac Trouble? Because she did not like the colour, a Bolton woman refused a free heart from the Corporation who are giving financial aid to residents in their town centre smokeless zone.—*Liverpool Daily Post.*

New Angle on the Problem.—"Smog attacks by making our skin dirty and forcing us to wash too often. This takes away the natural body fats and helps to create allergies."—Alan Dick, in the *Daily Herald.*

THE DIVISIONS

The annual two-day conference of the Scottish Division, which should have been held at Ayr on 26th May, was postponed because of the general election. It is hoped to hold it in the autumn.

The **North West Division** met at Widnes in February, and heard a paper by Mr. E. F. Starkey, Chief Sanitary Inspector. The meeting was in effect a tribute to the work of the Widnes Consultative Committee. Mr. Starkey discussed the fog experienced in November last, and deplored an unfortunate—and unpleasant—custom. " Some people," he said, " seem to think that fog is the signal to set their chimneys on fire. They never consider the unfortunate person who has difficulty in breathing even in normal weather."

The **Yorkshire Division** met in Sheffield, and after a morning business meeting, at which the Beaver report was discussed, paid a visit to the Department of Fuel Technology, Sheffield University. After a short introductory talk by Professor M. W. Thring on the work being done in the Department members were handed over to members of the staff, who demonstrated and explained the operation of the present work that is related to air pollution.

The **West Midlands Division** met at Brierley Hill on 21st April, when Mr. Alex Lee retired from the chairmanship and was succeeded by Councillor Eric Gibbons, Chairman of the Brierley Hill U.D.C. A visit was made to the glass works of Messrs. Stevens and Williams, and at the meeting which followed Mr. H. R. Hems, of the West Midlands Gas Board and Mr. C. Nield of the Midlands Electricity Board, gave papers on the uses of the two fuels in glass manufacture.

Meetings of the **East Midlands Division** have been a visit to the Coalite works at Bolsover, on 31st March, and to the Appleby-Frodingham Steel Works at Scunthorpe on 19th May. It is hoped to refer further to the latter visit in our next issue.

The new **South Wales Division** met at Cardiff on 23rd March, when a report was presented and a draft constitution for the Division was submitted for consideration and approved.

A visit to the Bankside Power Station was paid by members of the **South East Division** on 24th March. There was a very good attendance and an inspection of the new station was made after an introductory meeting had been held, in the course of which the problems of sulphur dioxide removal from the flue gases were clearly explained. The Division is arranging for a meeting in Oxford on 15th June, when there will be papers by Dr. A. R. Meetham and Mr. A. Ludgater, followed by a visit to the Nuffield motor works, particularly to inspect measures taken to prevent pollution from painting operations.

COAL PRETREATMENT

A reprint of a paper that appeared in *Fuel*, by A. H. Billington, of B.C.U.R.A., on work carried out in their laboratories, is entitled " Reduction in the Caking, Swelling and Smoke-Producing Properties of Coal by Pre-Treatment. It has been found that the smoke yield as well as the caking and swelling powers of coal can be greatly preduced by pre-treatment with nitrous oxide, nitric oxide or nitrogen dioxide at temperatures below the decomposition temperature of the coal. These effects are accompanied by the removal of a considerable part of the hydrogen from the coal substance, but by only a slight fall in the total heat of combustion of the sample. Useful applications of the reactions may possibly be found in reducing the caking and swelling powers of coal, as for example in the preparation of carbonized briquettes and perhaps in reducing the yield of powdered coal, which could then be made into uncarbonized briquettes.

SMOKE ABATEMENT IN PRACTICE

By

G. E. Foxwell, D.Sc., F.Inst.P., M.Inst.Gas E., M.I.Chem.E.

A Paper read to a joint meeting of the Institute of Fuel, the National Smoke Abatement Society and N.I.F.E.S., in Glasgow on 1 April, 1955. Dr. Foxwell, who was a member of the Beaver Committee, is a Past President of the Institute of Fuel and is their new representative on the Society's Executive Council.

THE position regarding the abatement of atmospheric pollution has changed so materially within the last six months that the old battle-cries have faded. It is true that no Clean Air Act is as yet on the Statute Book. Until it is, those who have been fighting this battle for so many years will no doubt keep their powder dry.

So recently as last February the Government announced that they had accepted and would incorporate in their Bill[1] six main recommendations of the report of the Committee on Air Pollution. The remaining recommendations are not rejected but require more detailed consideration, and some would not require an Act of Parliament to put them into effect. The recommendations accepted are these: (1) Subject to certain exceptions, the emission of dark smoke is to be prohibited by law. (2) In new plant burning pulverized fuel or large amounts of solid fuel, all practicable steps must be taken to prevent the emission of grit and dust. (3) The Government loan scheme for approved fuel-burning equipment in industry is to be extended to include equipment installed to reduce air pollution.

The first of these three accepted recommendations applies to all premises, except a few operations temporarily exempted, but in practice these provisions primarily affect industry. They apply to all industry in all parts of the country.

Now we come to our fundamental domestic recommendations that the Government has accepted: (4) Local authorities are to be given powers to designate smokeless areas, or smoke-control areas, subject to confirmation by the Government. (5) Householders in these designated areas will be obliged to convert their domestic grates to burn smokeless fuel and a portion of the conversion costs are to be borne by the Exchequer and the local authorities.

Finally, a general administrative provision: (6) The main duty of inspection and enforcement is to be placed on the local authorities.

It appears to me that this meeting tonight might with advantage consider how best to resolve the very considerable problems that acceptance of these recommendations will involve.

At the outset, let me make the point that the measures to be taken involve both administration and fuel technology. Without good administration the change will create personal difficulties and complaints; good administration will enable it to be performed smoothly and with satisfaction to all concerned. Unless the whole operation is well organized the clean air movement could receive a serious setback, even though it has the force of law behind it.

The Committee on Air Pollution did not contemplate high-handed action with widespread compulsion. It is left to the discretion of local authorities whether they should institute smokeless zones or not. That means that the majority of the citizens in any area must be in sympathy with the measures that the local government decided to take. Let me illustrate the spirit behind our recommendations by passages from the report. We recommend, and the Government has agreed, that industry should be placed under a legal requirement not to make dark smoke, but in Section III, we say:

> " We would emphasize our view that advice and co-operation are better methods of securing compliance with the law than prosecutions . . . local authorities should make it their practice to warn the potential offender in advance and advise him of the preventive measures they consider necessary."

In Section 120 we emphasize that the full support of everyone is needed:

> " Neither the Government nor local authorities are likely to achieve any

real measure of success unless all interests co-operate and unless public opinion, individual and corporate, clearly demands and will support the action that is required."

Whilst administration and education are supremely important, without first-class backing from the angle of fuel technology the whole operation would be impossible. It is not without justification that the Institute of Fuel has taken a leading part in providing a platform for the discussion of this subject. Fuel technologists can provide the tools. Local authorities and the fuel industries can finish the job.

INDUSTRY

Over the country as a whole, industry contributes 40 per cent of the smoke. The requirements for industry of the Air Pollution Committee now to be translated into legal requirements are in effect nothing more than a demand that industrial fuel-using plant shall be modernized, maintained in good order, and operated skilfully. There is a great deal of inefficient and, indeed, aged plant in this country. The Ministry of Fuel and Power[2] has published particulars of 10,800 boilers. Half of them are over 30 years old, and 30 per cent of them are over 40 years old. There would seem to be little doubt that a large amount of coal could be saved by modernizing boilers and furnaces throughout the country. Many of them will need to be modernized if their owners are to keep out of trouble under the Clean Air Act.

It would be impossible to provide industry with sufficient smokeless fuels to replace more than a small fraction of the coal burnt in its raw state. Electricity for power and industrial gas for heat are taking an increasing share of the load, but for most purposes their cost is prohibitive. For well-known technical reasons, boilers and furnaces burning bituminous coal and oil will generally emit a light haze of smoke, and over very limited periods will even give rise to dark smoke. Bearing the practical facts in mind the Air Pollution Committee came to the conclusion that taking the country as a whole it should be possible within a comparatively short time to reduce smoke by 80 per cent.

The means for doing this are available and can be applied without asking industry to shoulder any financial burdens. In brief, boilers and furnaces should be put into good order and maintained in good order; hand-firing should be largely replaced by mechanical stoking or oil; dust extractors should be installed wherever there is likely to be emission of grit and dust in any quantity; stoking should be regarded as an operation requiring skill and firemen, *when skilled*, should be remunerated accordingly; adequate instruments should be provided and maintained in good working order to enable the fireman to operate his furnace properly and to see the amount of smoke he is making at any time.

The Government loan scheme enables the capital for the new plant that is necessary for preventing air pollution to be advanced and repaid during the period over which the equipment is being written off for taxation purposes. The tax relief together with the savings in fuel costs will generally result in the modernization of plant showing a profit after repayment of loan and interest and deduction of tax. Two examples[3] have been published recently which illustrate the general principle.*

Smoke in amounts that would contravene the Clean Air Act is evidence of inefficiency. Can it be doubted that by asking industrialists to modernize their plant and keep it in order, we shall add to the capacity of their steam-raising plant and furnaces and in many cases production will be improved through better steam supplies and better control of heat? By promoting fuel economy through legislation we shall assist industry materially without imposing financial burdens.

The responsibilities of all concerned for education and training must be emphasized. It is difficult to use fuel efficiently on a works and to avoid making smoke unless the works engineer and his assistants are fully conversant with the proper handling of fuel plant. Plant engineers must look to their own training. Many more of them should become, according to their qualifications and experience, corporate or non-corporate members of the Institute of Fuel and so keep themselves up to date. Management should encourage not only this, but also—on a lower plane—the training of their firemen, and should encourage them actively to obtain City and Guilds Certificates of competency (the Boiler Operator's Certificate). Smoke elimination cannot be divorced either from plant engineering or from fuel technology.

If the local authorities are to administer

* See Appendix

the Act, will the duty of advising industrial offenders fall on them? In general, few sanitary engineers or smoke inspectors are qualified fuel technologists. The alternatives merit consideration. Should local authorities employ fuel technologists; should they enlist the services of fuel technologists employed by local firms or operating as consultants; or is closer collaboration with the National Industrial Fuel Efficiency Service the proper answer?

RAILWAYS

Railway smoke, although only 15 per cent of the whole, is a particular nuisance in towns containing main-line stations, shunting yards and, particularly, termini as in Glasgow and London. The Air Pollution Committee has recommended electrification, with the replacement of steam engines by diesel engines as an interim measure, or for routes unsuitable for electrification, together with the total replacement by 1960 of all shunting engines, whether railway-owned or privately-owned, by engines not using bituminous coal.

The British Transport Commission's proposals for modernizing the railways fulfil the recommendations for abatement of air pollution on the publicly-owned railways. The replacement of coal-fired shunting engines on industrial works is not covered by the railway report, and since the cost may be considerable, consideration should be given to substantial raising of the Government loan limit of £30,000.

DOMESTIC

The problems of industry are straightforward since they involve nothing more than the application of plant that is already on the market, and of methods of maintenance and of training personnel that are already known. The domestic problem is much more complicated because it involves the co-ordination of many factors.

It is a primary condition for success in the domestic sphere that the domestic consumer shall be satisfied with the arrangements made for heating his house and his water and cooking his food by smokeless fuel. Cooking is comparatively easy. There are already nearly 12 m. gas cookers and a million or so electric cookers in use, and so we could fairly conclude that people generally in the future would be satisfied to cook with these smokeless fuels.

The Problems of Domestic Supply

We recognized that nearly all the solid fuels available could be used in closed stoves and quite a lot in open-closed stoves, but we found throughout the country a very general demand for at least one open solid-fuel fire. It was immediately apparent that the existing coal-burning grates would be quite unsatisfactory for use with the great bulk of the solid smokeless fuels available. They are also fundamentally inefficient; but it was not part of our remit as an Air Pollution Committee to consider fuel economy or national fuel policy. In order to burn the solid smokeless fuels available, it will evidently be necessary to replace, on a very large scale, the existing grates and appliances by modern coke-burning appliances. Another problem immediately met us, namely that most of the coke now coming out of gas and coke works would not burn satisfactorily on even a modern coke-burning open fire. Finally, it quickly became evident that there would be nothing like enough smokeless fuel of any sort from present production or from production planned in the near future.

As if those problems were not enough, local opinion in many areas insisted that coke was already too high in price and that it was an unpopular fuel, while the gas industry on the other hand foresaw an increase in price to meet our requirements and immense difficulties in relinquishing their hard-won industrial and general markets to supply the domestic consumer on a much larger scale. They further pointed out that to reduce the price of coke materially would so increase the price of gas that sales would be gravely affected; and they could not make coke at all if the gas remained unsold. The view was also advanced insistently that carbonization coal was in short supply already and that it was most unlikely that any additional coal could be made available for carbonization.

How these problems can be solved is set out in the report of the Air Pollution Committee. I will here indicate the solutions briefly and discuss some of their technical features.

Fuel Required

Because insufficient fuel was available to supply domestic consumers over the whole country, we decided to attack first those areas that were subject to fogs and suffered from smoke due to heavy industrial or domestic pollution. These, we termed " black areas." We found that in those areas there was broadly 19 m. tons of house coal to be displaced, including unsatisfied demand due to

rationing. On the assumption that 20 per cent of the replacement would be by coke boilers and closed or openable-closed stoves, we found that the solid smokeless fuel for these appliances could be obtained from existing sources. The industries concerned agreed that some millions of tons of smokeless coals or coke could be replaced by oil or non-coking coal and transferred to the domestic market. A certain amount of the smokeless fuels so released could be made suitable for the open fire.

We found ourselves left with a very large deficit. To close this gap we considered alternative methods of heating, including electricity. It is common ground that this country must seek to economize in coal. Electricity, like gas, suffers from the high cost of meeting seasonal demands and we agreed with the Simon and Ridley Committees that the main winter space-heating load must be taken by solid fuel. Moreover, since between 1.2 and 1.5 tons of electricity coal would be needed at the power station to replace 1 ton of house coal burnt on the old domestic open grate, it was felt that the nation could not afford to use electricity for domestic heating on a large scale. Carbonization, with use of the products in modern appliances, can be shown, on the other hand, to economize in coal. So we looked to the carbonizing industries and in particular to the gas industry to bridge the gap and to become the main source of the necessary fuel. This involved plans for the carbonization of an additional 10 m. tons of coal a year.

The overall picture that we arrived at was this:

	Coal replaced	
	Closed stoves, m. tons	*Open fires, m. tons*
Coal to be replaced	3.80	15.20
Replacement by:—		
Anthracite and smokeless coals	2.53	—
Hard coke ..	0.75	1.43
Gas coke transferred from other users ..	0.52	3.75
Electricity ..	—	1.38
Gas coke, new production ..	—	5.00
Gas, new production	—	3.64
	3.80	15.20

The carbonization of the additional 10 m. tons of coal will give rise to some 800 m. therms of gas for which a use must be found. We have suggested that 360 m. therms would be used to replace house coal for water-heating, bedroom and other intermittent heating, and short-period space-heating, the remainder being used by industry. We visualize the additional plant being provided as required over a period of 10 to 15 years.

Appliances for domestic heating

How are the appliances to be provided? We have proposed, and the Government has accepted, that the essential new appliances in the black areas shall be largely paid for out of public funds. Our conception of this was that the main space-heating appliance only should be so replaced at the public expense, with an exception when an old coal-burning range needed replacement. We suggested that £10 a house might cover on the average what we had in mind. Coke-burning appliances should be equipped with gas ignition if the consumer is to be satisfied with the time required for lighting the fire.

There is a large gap between this and a modern well-equipped house and it was left to the householder to buy better appliances and more appliances for himself, aided by hire-purchase and other schemes promoted by Area Gas Boards or traders. Let me enlarge upon this.

I must recall to mind some passages in the report of the Simon committee in 1946:

> " The area of the house properly warmed for comfort during the winter is probably smaller in Britain than in any other civilized country."
>
> " Our coal is used for domestic heating with a degree of inefficiency which is not even approached by any other country in the world."
>
> " We cannot afford to maintain our low standards of heating."

The nation is committed as a principle of both national and local government to raise the general standard of living of our people. Our domestic heating is part of our standard of living. If we wish to make our houses more comfortable, we must provide constant hot water, day and night, summer and winter, without the need to light a fire when hot water is wanted on a warm day. We must provide a cooker easily handled. We must warm our living-rooms and bedrooms effectively.

Can it be doubted that whether we embrace a policy of burning only smokeless fuels or not, the replacement of our obsolete means of heating must be a major objective of those who seek to raise the general standard of living?

We must face the fact that to equip a

house properly with modern-comfort heating appliances—space-heating, water-heating and cooking—will cost about as much as a television set. But I submit that it will give a far better return on the capital invested. An immense amount of research and development work has been put into the subject of domestic heating. All that is necessary is to apply what is available. In that you will observe an interesting parallel between industrial plant and domestic appliances.

To be more precise, the Gas Council submitted to our Committee schemes for a complete heat service, by a combination of coke and gas for houses of 800 sq. ft. and 1,000 sq. ft. area. Here is a summary of the cost for one of these:

	£	*s.*	*d.*
Appliances	82	6	6
Purchase tax on gas appliances ..	13	13	6
Installation costs	14	0	0
	£110	0	0

People are ready to put down such a sum for a television set. Cannot we educate them to buy modern fuel-consuming appliances on similar lines to keep themselves warm and comfortable? That is a challenge to those who teach social science and to local authorities. In particular it is a challenge and an opportunity to the gas industry and to the Coal Utilization Council.

The capacity of the appliance manufacturing industry will be equal to the task imposed upon it so far as quantity is concerned. It is hoped that there will be an improved standard of manufacture and design in many types of solid-fuel appliance. All this will take time, however, and the smokeless-zone programme must be organized to extend over some 15 years to enable each zone to be properly equipped and supplied.

Cost of Smokeless Fuel

We were told in no uncertain terms that people would be dissatisfied if smokeless fuel cost them more than their present heating costs. Too often those advocating this view spoke in terms of cost per ton of coal or coke. For technical reasons—one of which is that nothing is lost in smoke—coke gives a higher efficiency than coal in domestic appliances and this must be taken into account when calculating costs. On the other hand, to secure an improved quality of coke we had to envisage the possibility of an increased price of coke of up to £1 a ton.

Comparing coke in Glasgow at 110s. a ton with Group 4 coal at 106s. 6d. a ton, we obtained these figures for the cost of supplying 1 therm of "useful" heat into the room:—

	Cost per therm of useful heat *d.*	*Thermal efficiency* %
Coal in pre-war stool-bottom grate	19	25
Coal in simple improved open fire	16	30
Coke in simple improved open fire	12½	40
Coke+£1 a ton in simple improved open fire	15	40

The efficiencies were taken from the Ridley Committee's report.[4] With closed stoves, which have an efficiency of 65 per cent, coke is even more attractive, but few people like them. That is unfortunate since the problem of providing coke of a suitable character is much less difficult with closed stoves while a lot of fuel would be saved if their use could be sufficiently established.

What of the cost of using a combination of coke and gas? I would remind you that gas is the answer to the intractable problem of domestic emission of sulphur and, if only for that reason, is to be encouraged.

The Gas Council, through the Watson House organization, put forward proved combinations of appliances for providing all-the-year-round heating and cooking services to houses of two sizes using an appropriate combination of gas and coke. Here is the annual cost:—

House of ..	800 sq. ft. £ *s.* *d.*	1,000 sq. ft. £ *s.* *d.*
Coke	12 12 0	13 17 0
Gas	12 15 0	12 15 0
Total ..	25 7 0	26 12 0

Coal cost: Ridley Report Table F[4]

2½ cwt. for 33 weeks
1 cwt. for 19 weeks } 5 tons of coal .. £32 10s

Moreover, the coal in this comparison is used to provide cooking, water-heating and space-heating in one room, whereas the combination envisaged for gas and coke provides, *in addition:* (1) gas ignition for the coke fire; (2) gas fire in 1 bedroom; (3) means of cooking, water-heating and space-heating in the summer without lighting fires.

In putting these figures before you it is not my intention to advocate a particular system of heat supply, but to show that the use of smokeless fuels does not involve a higher cost for the heating service, and, properly applied and used, will lead to a higher standard of living—less work, hot water whenever required, greater comfort.

Quality of Coke

I have indicated that the quality of much of the solid smokeless fuel now

available, in particular that available for the open fire, leaves much to be desired. A British Standards Institution Committee is now in course of formation which will endeavour to lay down standards for coke for various types of domestic appliances including closed stoves, open-able-closed stoves and open fires.

The ash content of coke should be reasonably low; this is entirely a problem in coal cleaning. The behaviour of the ash provides some difficult problems. If the coal is not crushed, the resulting coke may contain " fliers," pieces of shale that disintegrate violently on heating. These fliers seem to occur in particular coals and can often be avoided by judicious selection of the coal. On the other hand, the venom is removed from them if the coal is finely crushed. When the coal is finely crushed however, the ash will be of very small particle size and is likely to become air-borne causing dust in the room when the fire is stirred, while it may adhere to the surface of the coke as it burns away, causing an unsightly appearance. It is quite possible that this may prove to be no more than an exercise in coal cleaning, since the " explosive " material appears to have a specific gravity of above 1.6.

The moisture content of coke should be about 5 per cent. If it is much less than this, the coke will be dusty. There are obvious reasons why it should not be much greater.

Coke for domestic use should be of consistent quality between one delivery and another. Too often a customer who has had two or three deliveries of continuous-vertical-retort coke made from a lower-rank coal, finds that the next delivery is quite different in quality—generally owing to being made from a higher-rank coal in a static retort—and is quite unable to use it successfully. If all producers worked to a British Standard Specification which includes " burnability," this difficulty would be overcome.

The major problem appears to be to provide open-grate coke of a sufficiently combustible character; possessing the quality of ready " burnability." One important step is proper sizing of the coke and, where necessary, cutting the coke into the proper sizes. The gas industry in many parts of the country has neglected coke and is now finding it necessary to spend a good deal of money on coke-preparation plants. Such expenditure should not be regarded as connected with the clean-air requirements; it will be necessary in any event if coke is to be sold in competition with other fuels.

While sizing, moisture and ash influence the behaviour of the coke on the fire, and correct sizing is of particular importance, none of them affect the constitution—and therefore the fundamental properties—of the basic carbonaceous material of which a coke is composed. These properties are a consequence partly of the composition of the coal from which the coke is made and partly of the treatment given to the coal during carbonization. As with human beings, cokes derive their qualities from parentage and environment during the formative period.

Some facts that are well-established are these:—

(1) Cokes made from low-rank coals, say coals of Groups 600 and 700, are more reactive than those made under similar conditions from higher-rank coals of Classes 301, 401, 402 and Group 500.

(2) Cokes made in continuous vertical retorts at high temperatures are more easily burnable than cokes made at similar temperatures from the same coal in static retorts or ovens. Experience has shown that cokes made from coals of Groups 600 and 700 in continuous vertical retorts, properly sized and of reasonable ash and moisture content, are quite suitable for use in modern coke-burning open fires.

(3) There is a critical carbonizing temperature, which varies for different coals but is generally not lower than 700°C. nor higher than 800°C., above which coke changes in character and becomes less easily burnable.

Many coals, particularly higher-rank coals, should not be heated above this temperature during carbonization if they are to produce a coke satisfactory for the open fire.

In the gas industry it is found that with horizontal-retort coke, the gas needed for ignition decreases with increase in volatile therm content of the coke up to a value of about 3 to 4 volatile therms a ton, but any further increase in volatile therm content has little influence on ease of ignition. A change in carbonizing conditions to enable 4 volatile therms to be retained has little effect on the gas yield. It may be suspected that retention of a few volatile therms is closely connected with the critical temperature just men-

tioned. Volatile-therm content is probably little more than a measure of the temperature to which the coke has been heated in the retort or oven.

(4) Any coal, even the high-rank 301 coals, can be made to yield an easily burnable coke if it is carbonized at a low temperature, i.e. if it is not heated above about 600°C. This is the basis of the Coalite process; but the fuel will be costly in terms of price per ton and more costly to the consumer in terms of pence a useful therm than Group 4 coal.

(5) Non-coking, low-rank coals can be carbonized in lump form and produce an easily-burnable coke. This is the basis both of the Rexco process and that in use in continuous vertical retorts in Granton gasworks, Edinburgh. If the gas generated in the retort is used to good effect, this type of process, I am convinced, could be so developed as to produce a very suitable fuel at reasonable cost.

(6) Advantage can be taken of the better combustible properties of low-rank coals to produce a coke that is strong and easily burnable. The lower cost a ton of the non-coking component of the blend should cover the cost of blending.

At the same time, it must be borne in mind that the yields of coke and gas from these non-coking and low-rank coals are less than from the true gas coals. There may be a reduction of 4 to 8 therms a ton or more in gas yield and up to 2 cwt. or 3 cwt. a ton in coke yield.

Bearing in mind these fundamental principles, it cannot be doubted that a suitable solid smokeless fuel can be produced in existing types of carbonizing plant. It is possible that new processes may be evolved, but the history of carbonization indicates that it is unwise to base firm plans on any new development until it is operating satisfactorily on a commercial scale.

It has been indicated to the Air Pollution Committee, however, that certain additional costs may be incurred in the production of this improved solid smokeless fuel. These comprise manufacturing costs such as blending, retention of volatiles in the coke, additional coke cutting and preparation, stocking, advisory service to consumers and more frequent deliveries. We thought it prudent to budget for an increase in coke prices of up to £1 a ton, but, as has been indicated, even after allowing for this increase, smokeless fuel in modern appliances costs the consumer less per therm of useful heat.

The fuel that is required for the replacement of the 19 m. tons of house coal burnt in black areas cannot be made available overnight. It will take time to arrange transfers of coke by replacing substantial existing tonnages by other fuels. The methods of carbonization and preparation must be modified to produce coke of the proper quality. Much can be done within 2 or 3 years, but the whole programme will take at least 10 to 15 years. Consequently, the principle of *festina lente* must be followed in designating zones. It would be fatal to designate a zone before the fuel and appliances were assembled and in position.

Coal Supplies

The nation is short of coal and future coal supplies are giving cause for anxiety. The gas industry has been kept so short of gas coal in recent years that it is now making gas from oil. Whence shall we obtain the coal for this ambitious programme?

The Gas Council in its evidence to the Ridley Committee[5] computed that (to quote the words of the evidence) " by replacing coal (used for domestic purposes) with coke burnt in modern efficient appliances in the winter and by gas for water-heating and occasional space-heating in the milder months of the year, and by restoring the electricity used to its proper function of light and power " there would be an annual saving of 15.77 m. tons of coal a year. It is not necessary to accept all the details of this calculation to conclude that the clean-air operation based on carbonization that we are here considering is likely to result in very substantial savings in coal.

Moreover, some 19 m. tons of house coal, large coal, will be replaced. For what will that coal be used? The 1953 report of the National Coal Board showed that in that year 56.5 m. tons of large coal were used in this country, of which 54 per cent were supplied to domestic consumers and 23 per cent to the railways. Neither the domestic consumer (in a smokeless age) nor the railways (in an electric and diesel age) will require the 19 m. tons of large coal that will be displaced. E. H. Browne,[6] Director-General of Production of the National Coal Board, indicated in February last that the use of large coal which is now consumed in open fires and steam locomotives should decline, and

added: " and so it should since the ways in which large coal is used are generally inefficient." As a great deal of this large coal is of the coking and gas types (500 and 600), sufficient coal for the smokeless-fuel programme could be obtained from this displaced coal alone.

Moreover, many millions of tons of carbonizable coal are now burnt under boilers. Why cannot some of this be replaced by oil or non-coking coals? If blending were selected as a means for making easily burnable coke, or non-coking coal were carbonized in lump form, supplies would be still further augmented. The operation may not be completely simple and straightforward; but, given adequate co-operation from all concerned, the coal needed can be made available to the carbonizing industries. This applies also to coal for the production of metallurgical coke—but that is another story.

Experience has shown that the technique of burning coke is somewhat different from that required for burning coal and that it is essential to organize a domestic advisory service. In addition to calls made at every house by knowledgeable demonstrators for discussion and demonstration, there must be a permanent advisory service. Gas Boards, and in many cases fuel merchants and the C.U.C., are prepared to organize this service. It has been very successful, for example, on housing estates.

It is equally important to train those who install the new appliances. Elementary mistakes are made astonishingly often and the fuel is then generally blamed because the appliance does not work. Much good work is here being done by the C.U.C., but there is still an immense amount of ignorance in the building and allied trades.

Organization of a Smokeless or Smoke-control Zone

Local authorities, as has been indicated, have a most important part to play. In Section 113 of our report we have said this:—

> " . . . the main responsibility for administering the statutory provisions for the control of air pollution should continue to rest with the local authorities . . . The task will be a formidable one, and it will be accomplished only if they are prepared and willing to accept the challenge. Our recommendations, if accepted, will place a heavy responsibility upon local authorities and progress towards cleaner air will depend very largely upon their efforts."

In amplification of this, let it be made clear that since we have insisted that results can only be secured if " public opinion, individual and corporate, clearly demands and will support the action that is required," the smokeless zones must be so organized and administered that those who live in them will be satisfied with the change from coal to smokeless fuels. Technically, in the provision of suitable fuels and appliances, what has been here said should have indicated that the fuel industries are fully aware of the tasks that await them, are taking steps to cope with the problems involved and will give satisfactory service.

Our proposals in effect leave the decision whether an area is to be smokeless or not to local option. The first responsibility of the local authorities, therefore, is that of educating the public and of persuading them that clean air is good for them and that they should themselves accept the challenge to change their ways. Many other bodies will assist in this educative process.

When it is clear that an area can be made smokeless, it is then necessary that the local authority, with the co-operation of the fuel industries, the fuel merchants, and other appropriate organizations should ensure that there is an adequate supply of suitable fuel, that modern appliances of the right type are installed wherever necessary before the date when the zone is to come into effect and that there are adequate arrangements for the delivery of the fuels. Most modern solid-fuel appliances will burn coal and so the appliances can be installed well in advance of the date when a zone must become " smokeless."

The Ministry has to approve of the order to institute the zone. This is necessary to avoid too-hasty action, and to co-ordinate what is done throughout the country. Nothing would be more disastrous than for a number of zones to be instituted as smokeless or smoke-controlled all over the country, and for them to prove failures because the right appliances had not been installed in advance and the right fuel was not available in sufficient quantities.

CONCLUSION

In the course of the time at my disposal, I have been able only to touch on some of the high spots of the gigantic but beneficial operation on which we are now engaged. I hope I have convinced you that the

method of tackling this problem has been very carefully thought out and that what is proposed is practical. The cost to the individual concerned should be very small and what he is asked to do is very much to his advantage. Industry and the domestic consumer alike are asked to modernize their outworn methods of using fuel. You—local authorities and fuel industries and private citizens—are asked to undertake a work that will be of no small value not only to yourselves, but to posterity. A great writer once said: "The men who build the future are those who know that greater things are yet to come, and they themselves will help bring them about." To-night, we are building for the future. But to build on secure foundations, nay, even to build at all, the co-operation of everyone concerned is essential—the Government, the nationalized fuel industries, the local authorities, the citizens not least of all. Macaulay wrote that "the history of England is the history of progress." I am sure that he referred also to Scotland. Clean air, better use of fuel, better conditions in the home—these are Progress.

APPENDIX

Examples of the Financial Effect of the Government Loan Scheme

Example 1.—Installation in a brickworks of insulated down-draught kiln. Capital expenditure £5,000; loan, £5,000; repayment period, 7 years; interest, 5 per cent with first 2 years interest-free; and coal saving 300 tons or £1,330 a year. From savings in fuel costs, plus tax reliefs (i.e. 20 per cent investment allowance and the annual depreciation allowance) the firm will have repaid the loan and interest, and retained £1,400 after 7 years. The figures for the 7-year period are:—

	£
Allowances to be set against tax ..	4,036
Fuel savings	9,310
	13,346
Interest payments (5 years)	550
Gross benefit before tax	12,796
Net benefit after tax	6,398
Capital repayments	5,000
Surplus	1,398

The depreciation rate in this example is taken at 12½ per cent per annum (i.e. basic rate of 10 per cent plus the additional one-quarter). During the remaining years of the equipment's life the firm will continue to gain £1,330 per annum in fuel-saving (£665 per annum after tax) and will also obtain further tax allowances amounting in all to £1,964 (£982 actual tax saved).

Example 2.—Pulverized-fuel-firing system. Capital expenditure, £6,000; loan, £6,000; repayment period, 10 years; interest 5½ per cent with first 2 years interest-free; coal saving 700 tons a year or £2,310 a year. The net benefit from the savings in fuel costs and the tax reliefs (the equipment being written down by 6½ per cent per annum) will more than cover the original cost of the investment in 5 years. The figures for 10 years (the period of the loan) are:

	£
Allowances to be set against tax ..	4,054
Fuel savings	23,100
	27,154
Interest payments (8 years)	1,188
Gross benefit before tax	25,966
Net benefit after tax	12,983
Capital repayments	6,000
Surplus	6,983

During the remainder of the life of the equipment the firm will continue to gain £2,310 per annum in fuel saved (£1,155 per annum after tax) and will also obtain further tax allowances amounting in all to £3,146 (£1,573 saved.).

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1. *Hansard, House of Lords Official Report*, 16th February, 1955, **191**, cols. 130 to 131.
2. Ministry of Fuel and Power Statistical Digest, 1953 (H.M. Stationery Office), Table 17 of Steam and Power Survey.
3. *Times Review of Industry*, March, 1955, pp. 12 to 13.
4. Report of the Committee on National Policy for The Use of Fuel and Power Resources (Ridley Report, Cmd. 8647, H.M. Stationery Office, 1952), pp. 82 to 83.
5. *ibid.*, p. 172.
6. *Trans. Instn. Min. Engrs.* (to be published).

A report to the Urban District Council on five years of atmospheric pollution measurements in Corby has been made by their Chief Sanitary Inspector, Mr. G. H. Wilkinson. There has been a reduction in the solids pollution despite the considerable increase of iron and steel production, and credit is given to the local steel company for the technical developments in various processes that have brought this about. On the other hand, sulphur dioxide pollution has increased and the evidence points to the domestic grate as the major source. A smokeless zone in the south-west area is envisaged.



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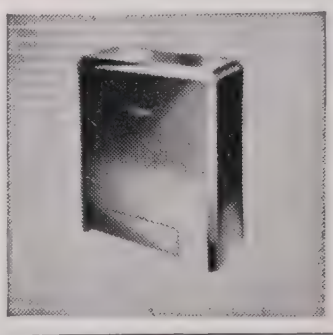
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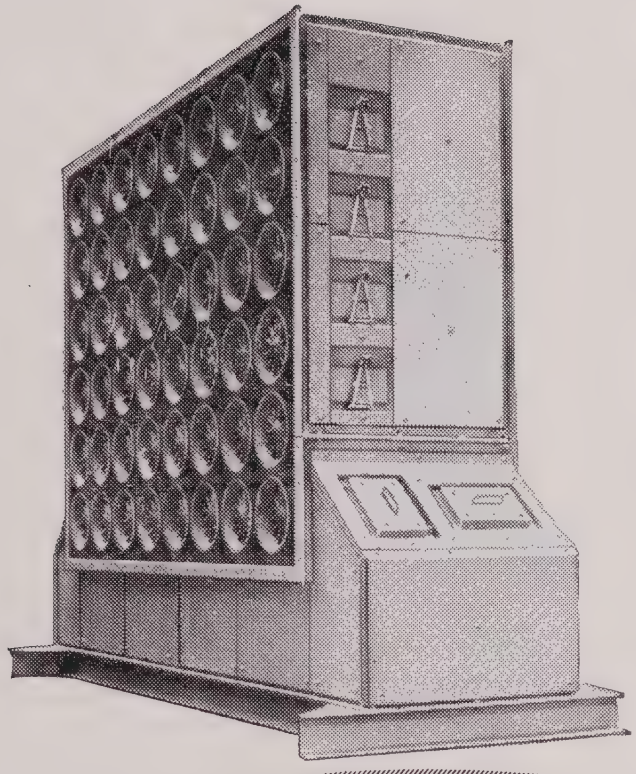
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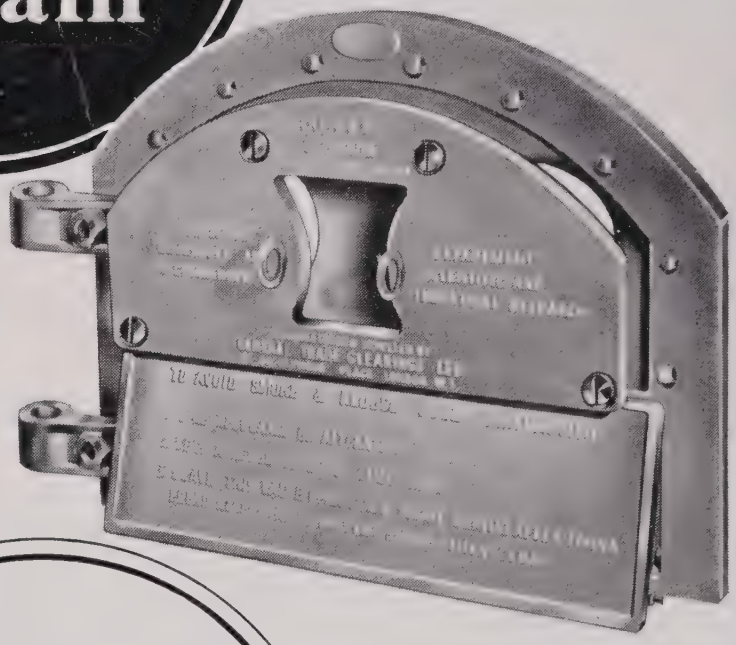
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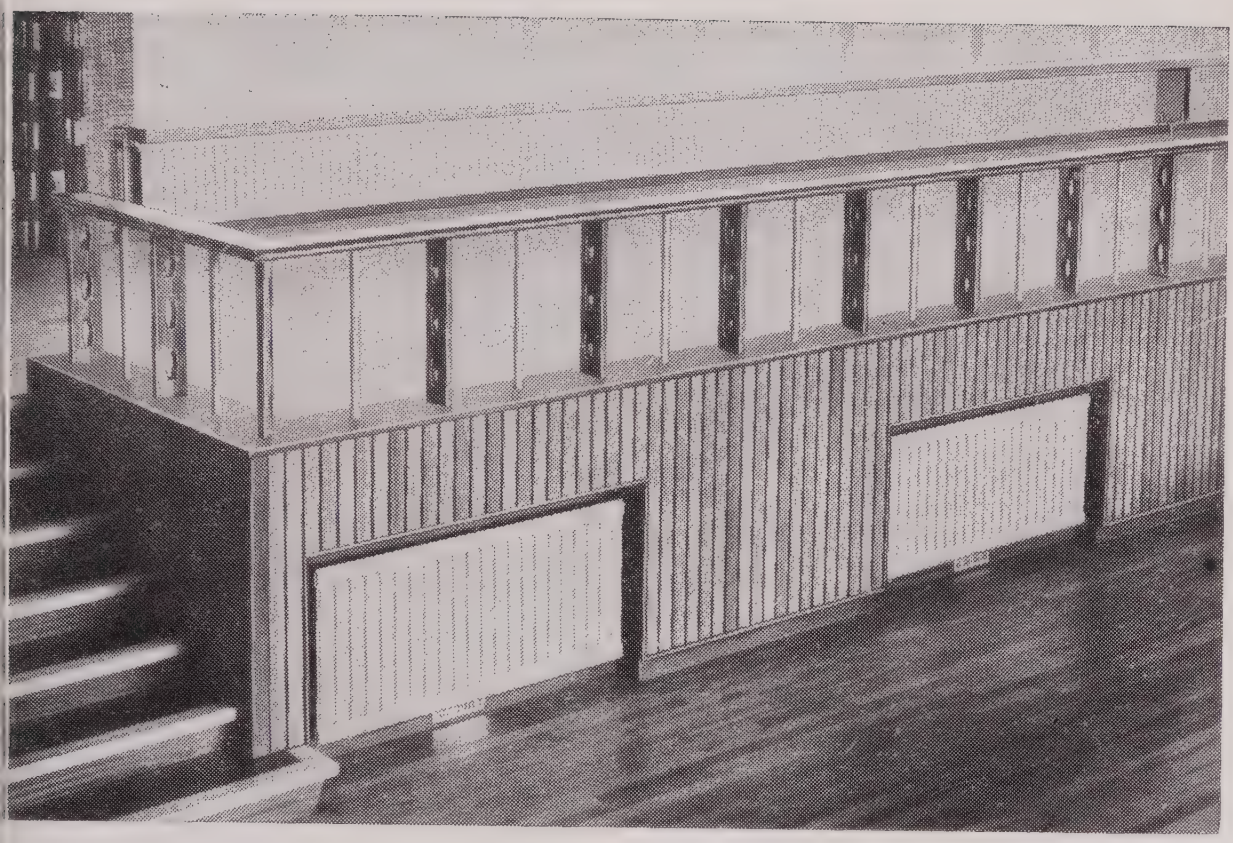
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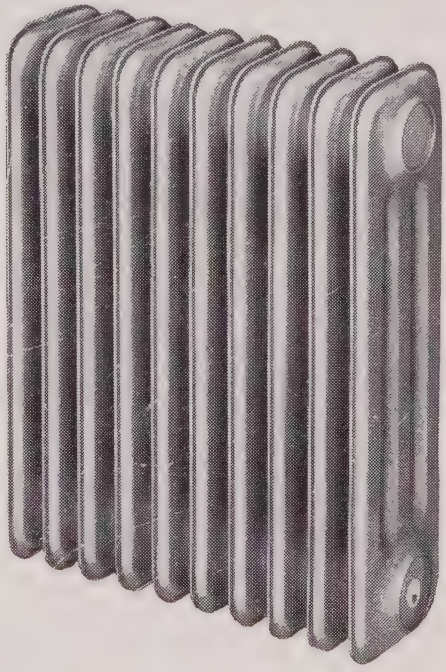
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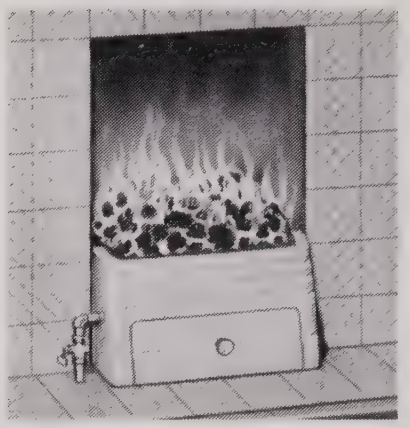
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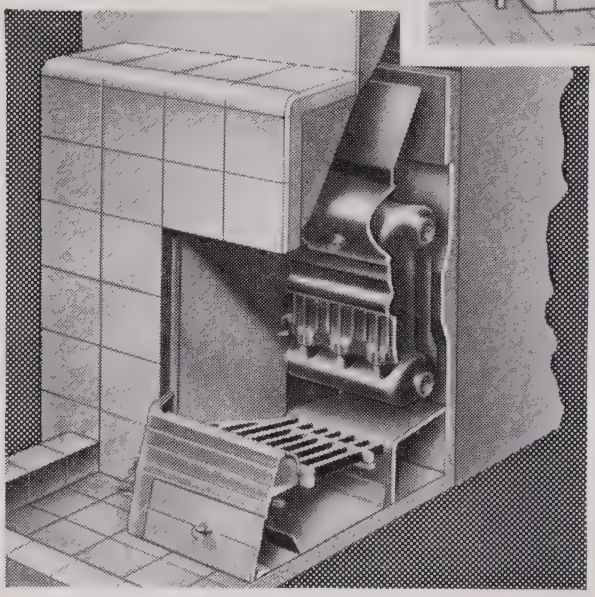
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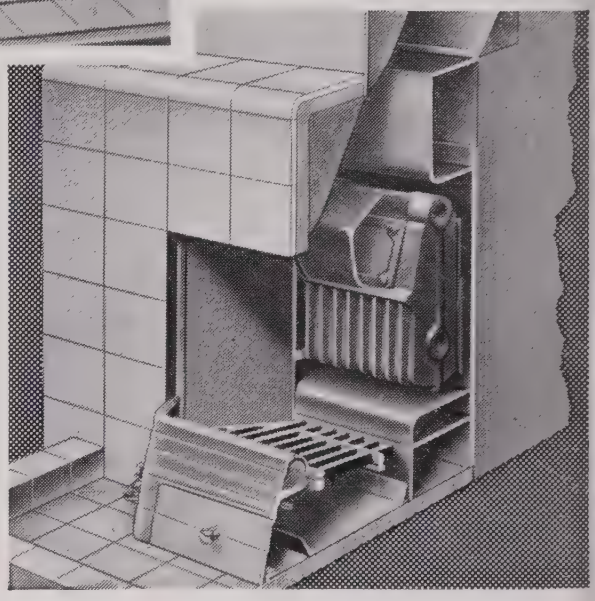
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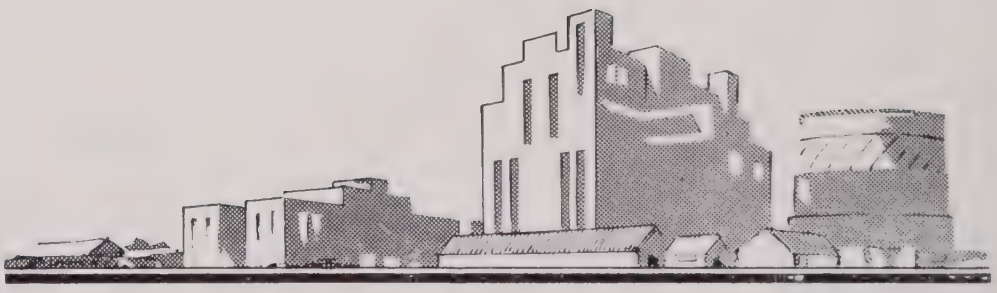
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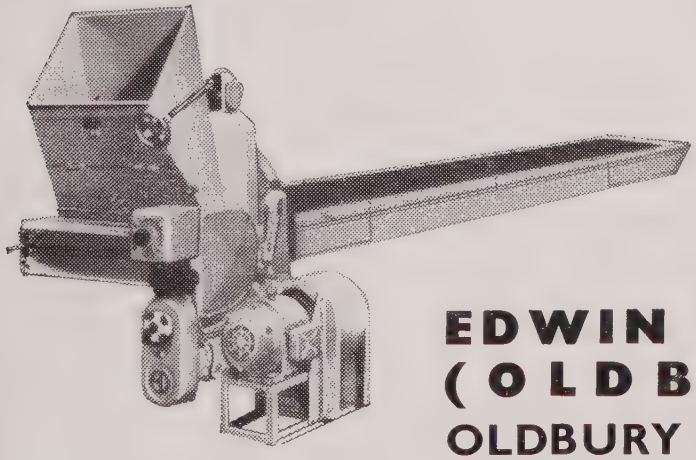
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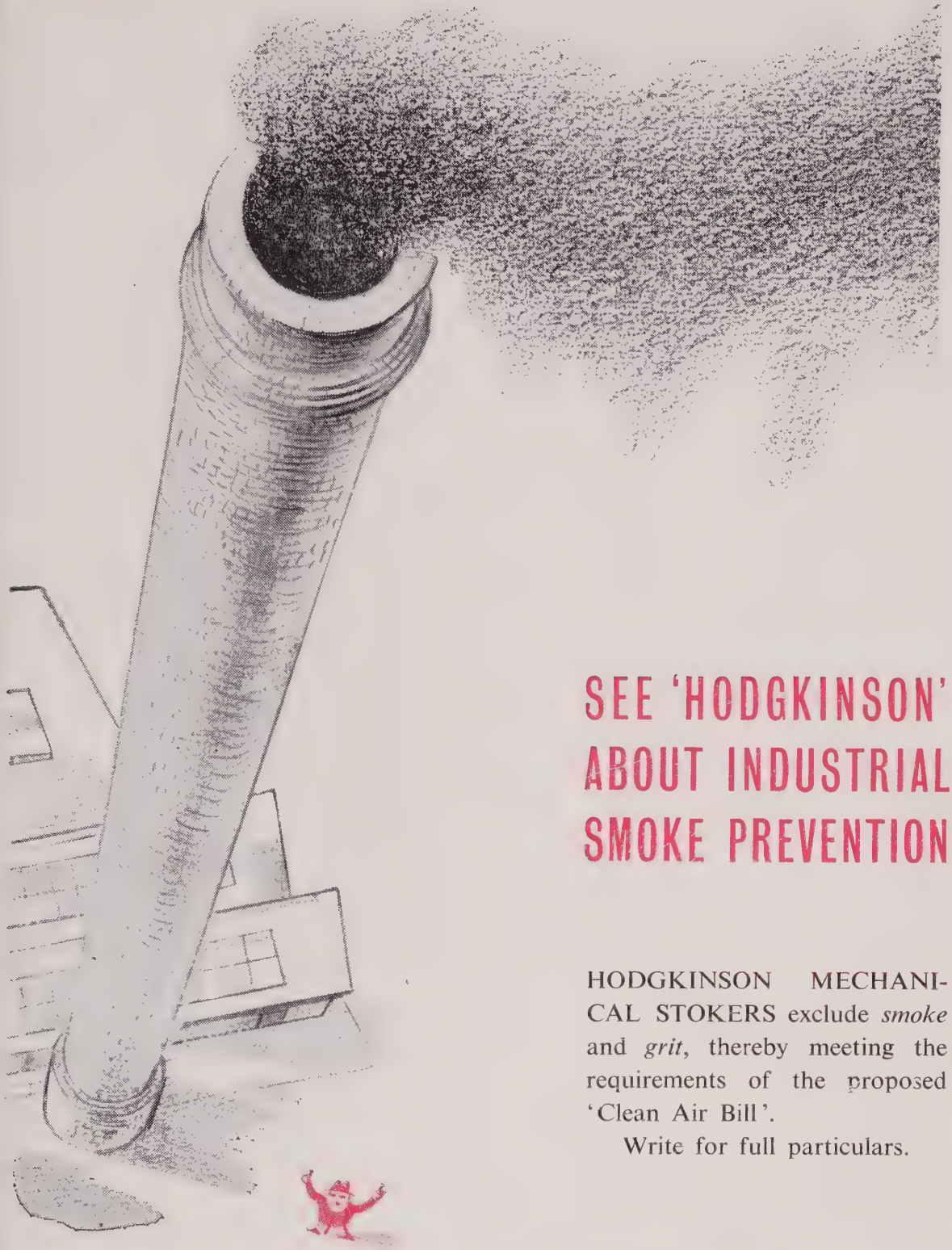
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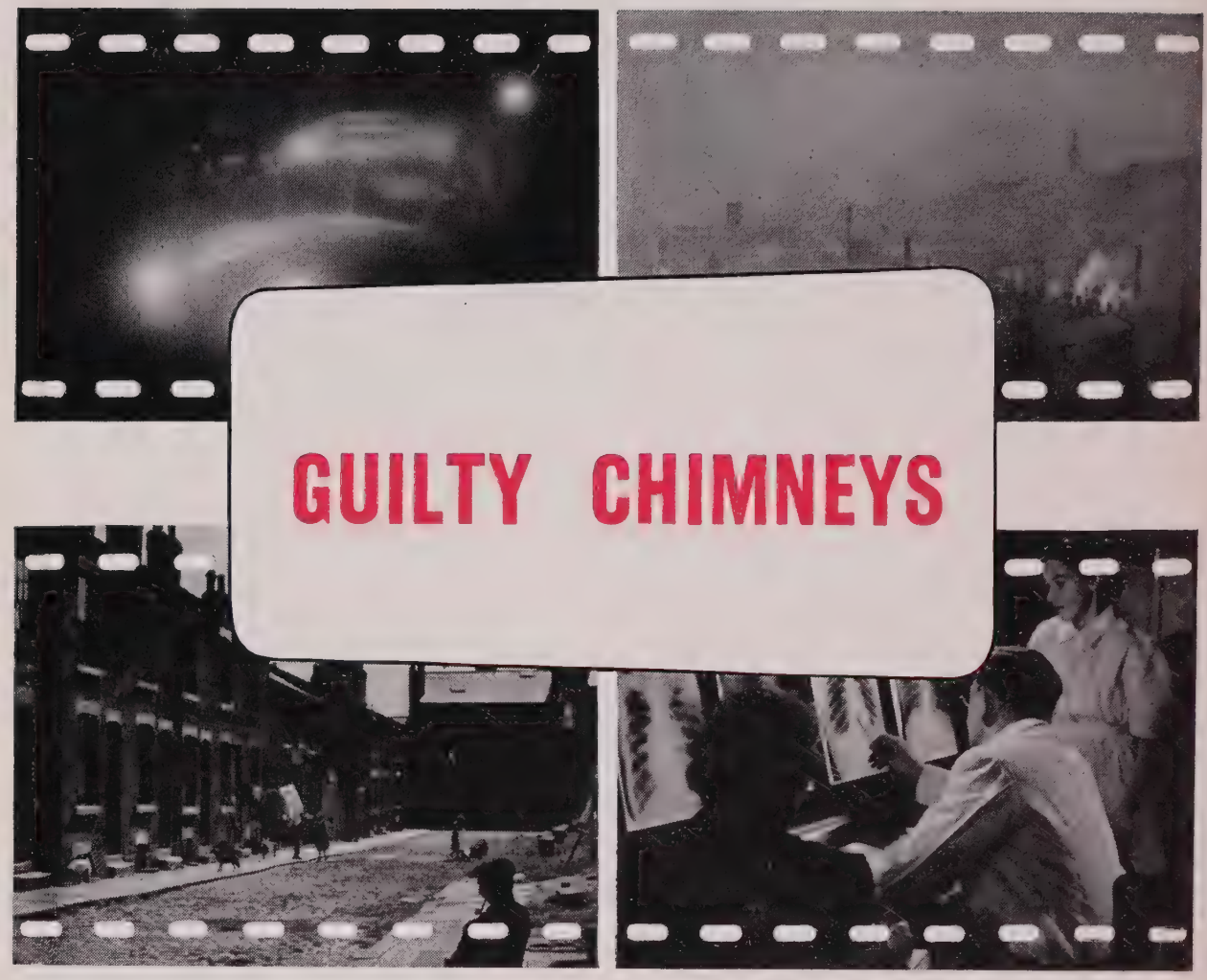
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SMOKELESS AIR

THE SMOKE ABATEMENT JOURNAL



No. 95 AUTUMN 1955

ONE SHILLING

In this Issue

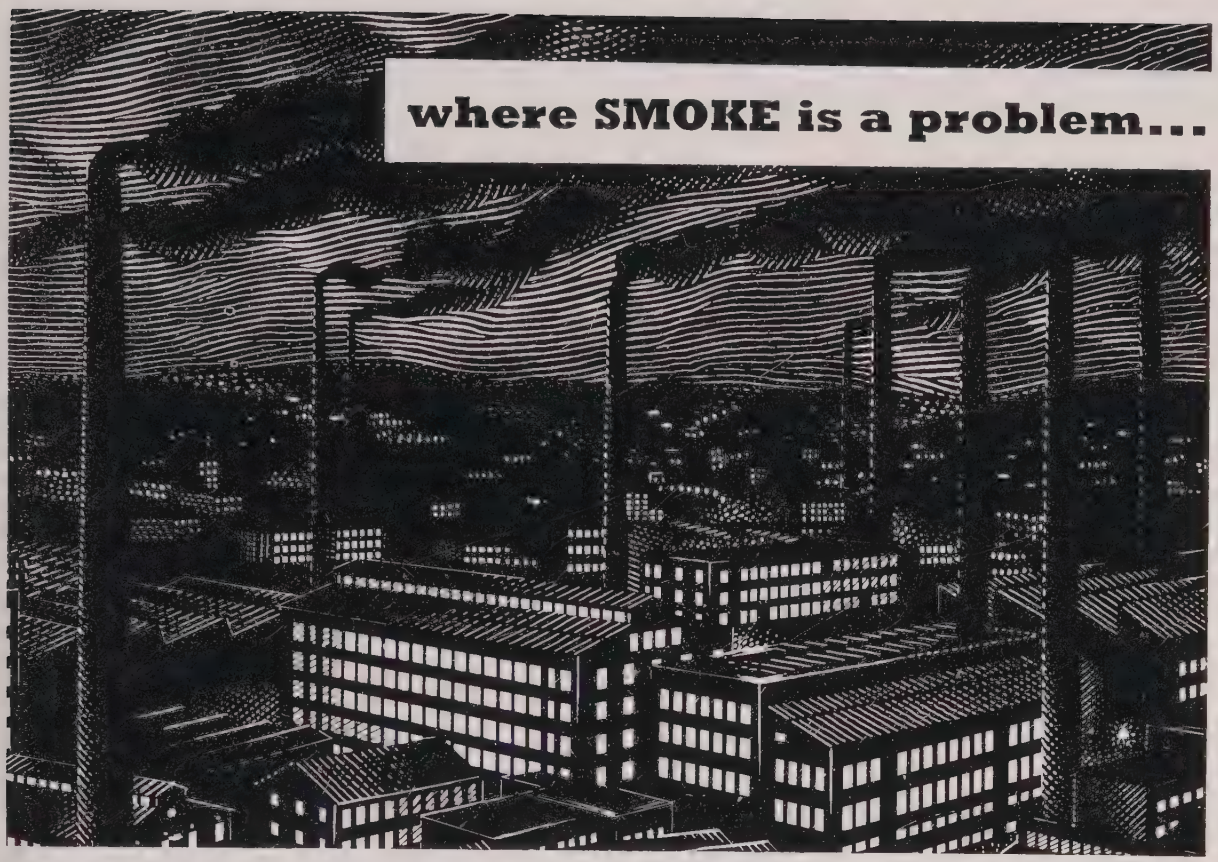
The Clean Air Bill—Outline and Comment
The Work of the Society
An Effect of Flue Gas Washing
Introducing a Smokeless Zone
Three Fuel Reports



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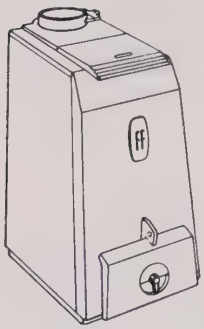
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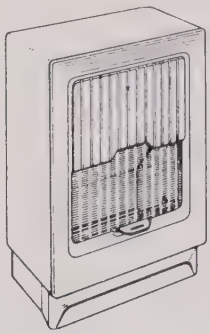
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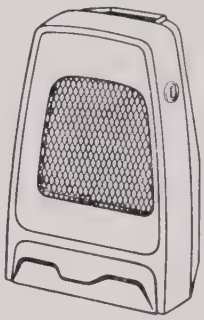
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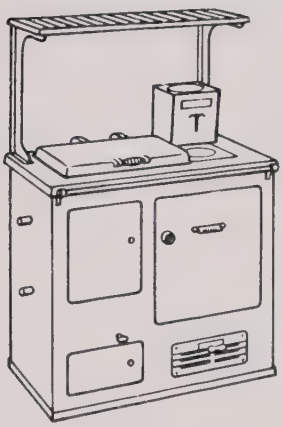
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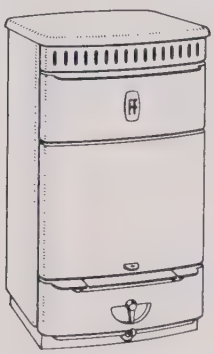
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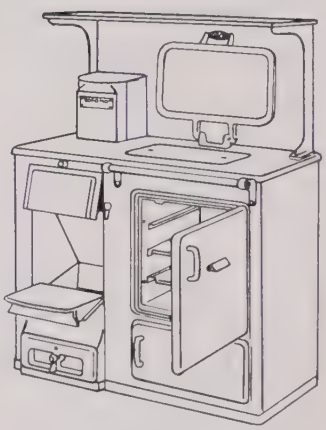
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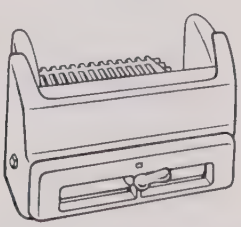
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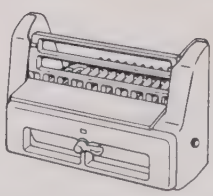
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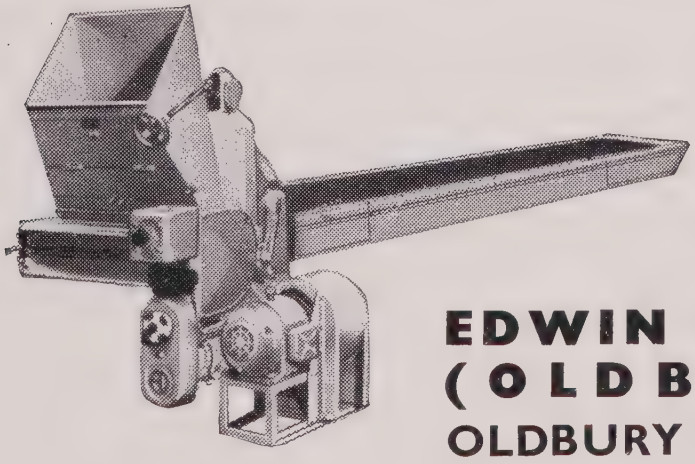
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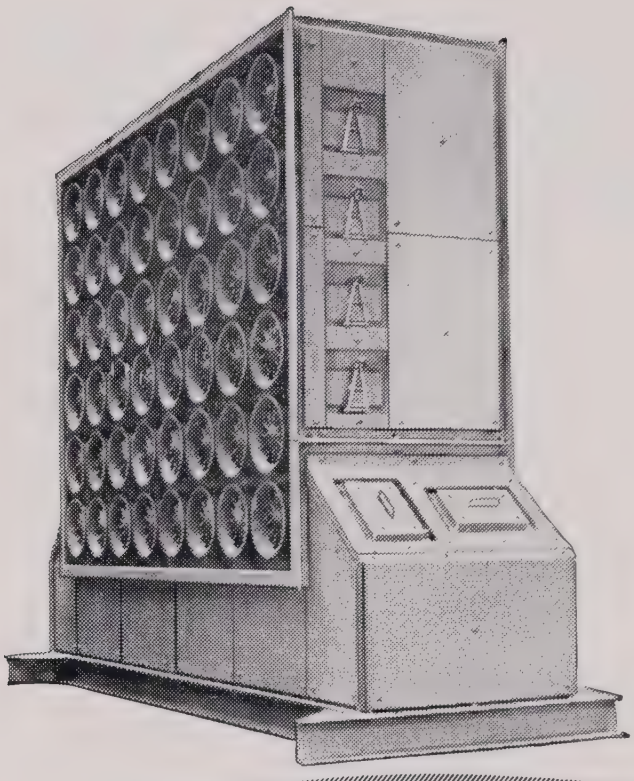
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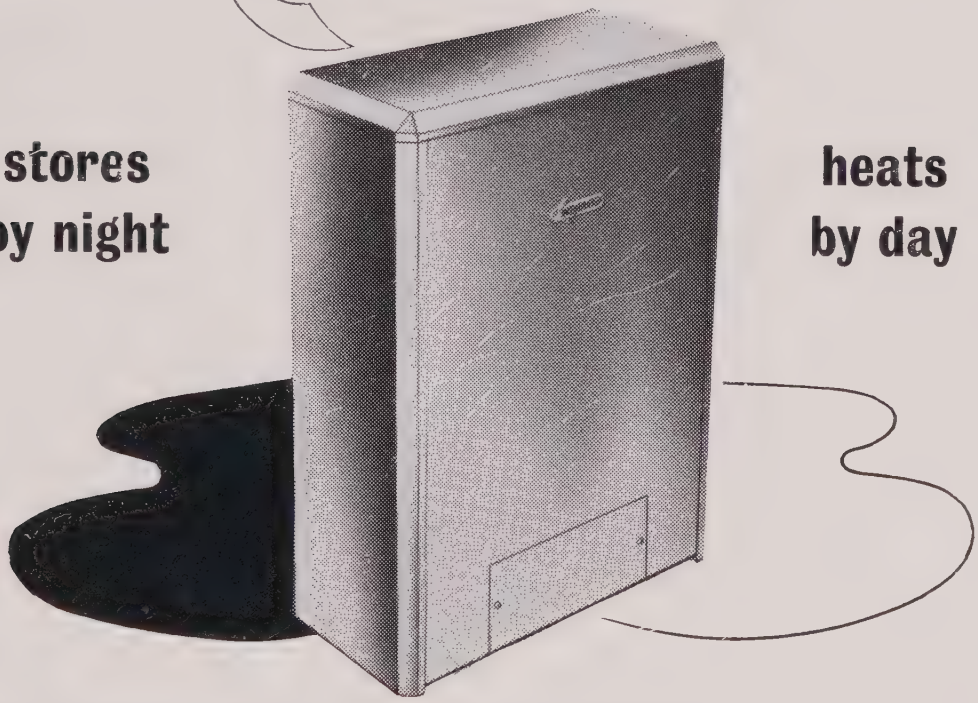
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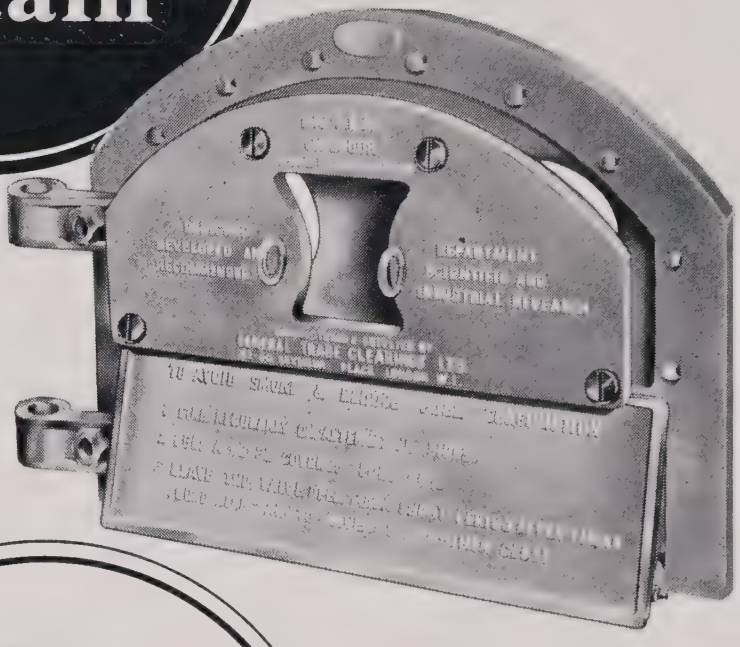
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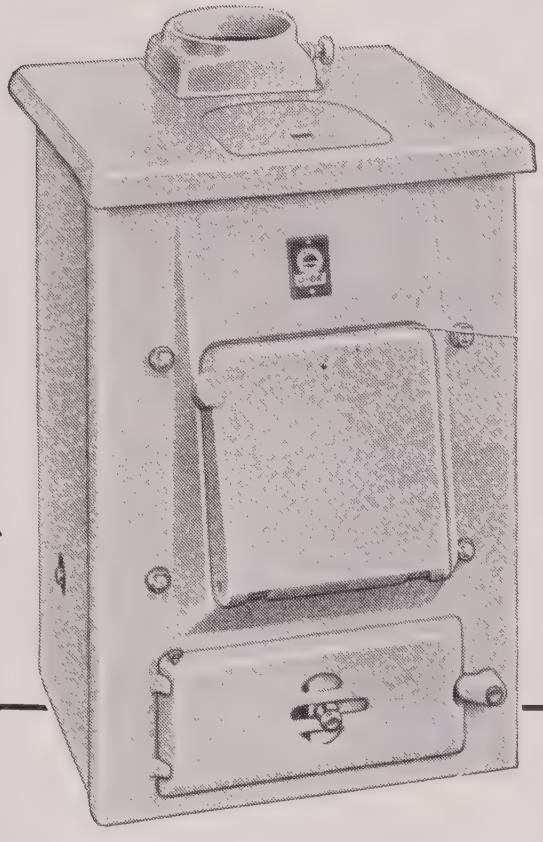
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SMOKELESS AIR

Vol XXVI. No. 95 Autumn, 1955

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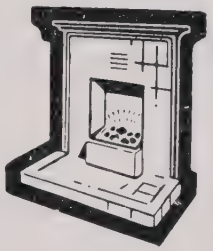
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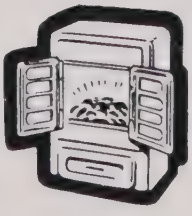
The Solid Smokeless Fuels Federation

is a group of organisations responsible for practically the total production of solid smokeless fuels in Great Britain, amounting to 38,500,000 tons per annum. One of the main objects of the Federation is to ensure that solid smokeless fuels are used as efficiently as possible. The combined technical and scientific resources of the Federation, in association with appliance makers, are continually employed in developing high efficiency equipment both for the home and for industry.



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Solid smokeless fuels give a *higher* proportion of *radiant* heat than household coal. Consequently you get more useful heat from approved domestic appliances at a *lower* cost for fuel.
Appliances designed for solid smokeless fuels provide easy and accurate control of the rate of burning and heat output. This makes them extremely economical to run, and capable of long burning periods and overnight banking, thus saving work and attention.
Solid smokeless fuels are graded in a wide range of sizes and in a variety of types to ensure satisfactory performance in all domestic appliances.
Modern solid smokeless fuel appliances usually incorporate a built-in gas burner or gas poker. Lighting up is therefore simple, clean and convenient. No wood or paper is required.
These fuels are smokeless and sootless. They save dirt and work in the home and help to keep house furnishings and paintwork clean.
Solid smokeless fuels are conducive to better atmospheric conditions and improved standards of health.



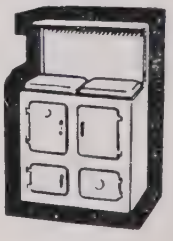
Which are the Solid Smokeless Fuels?

They comprise chiefly (1) the natural smokeless fuels, Welsh Anthracite and Dry Steam Coals, and (2) the manufactured smokeless fuels, Gas Coke, Hard Coke, Low Temperature Coke (''Coalite'' and Rexco) and Carbonised Ovoids. The natural fuels are obtained from underground coal seams. Both are dense fuels with a low ash content providing highly desirable long-burning properties. The manufactured fuels result from the carbonisation of coal in retorts or ovens, whereby the smoke-producing substance present, known as its ''volatile content'', is converted into gas and tar, the source of valuable by-products for use in home and industry. Carbonised Ovoids are marketed under the trade name of ''Phurnacite''. They have a uniform shape, a low ash content and are very similar in burning properties to Anthracite.



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SMOKELESS AIR

The Bill

THE promise given during the debate on the Nabarro Bill, that a Government Clean Air Bill would be introduced "during the present session" was faithfully kept, even though by the narrowest margin. On other pages will be found an outline of the main provisions of the Bill and a selection of the considerable amount of press comment it received. It is, of course, to be discussed at some length at the Society's forthcoming Bournemouth conference, and is at present being studied in detail by the Technical Committee of the Executive Council.

Although there are likely to be a number of criticisms on detail, and one or two on matters of major importance, the consensus of informed opinion is definitely that the Bill is a considerable and gratifying advance on existing legislation. Apart from all else it has the merit of banishing into limbo all the bits and pieces of antiquated legislation and of bringing everything together (including Scotland!) in the one enactment.

There are signs that the main storm centre will be the clause giving control

of the " special cases " to the central authority. This is strongly opposed by many local authorities, and seems likely to be defended just as strongly by some of the industrial interests. There is a great deal to be said for both sides, and much independent opinion, which considers that who does the job is of less importance than seeing that it is done effectively, is hoping that the Bill will not be weakened, or its enactment delayed, by undue concentration of attention and discussion on this single point. The Nabarro Bill contained a useful compromise, and even now it might not be too late to explore the possibility of some kind of condominium that would satisfy all.

The explanatory memorandum to the Bill states that the cost of the augmented Alkali Inspectorate would ultimately amount to about £40,000 per annum. Taking into account not only the salaries of the inspectors, but the administrative, clerical and travelling costs, the number of inspectors looks like being no more than a couple of dozen.

Another criticism, already voiced by Mr. Nabarro and others, is that the seven-year exemption period for dark smoke emission is much too generous a period. If it is retained it will certainly create a seven-year itch among the local authorities who want to get on with the job!

The End of Smokeless Zones ?

Some disappointment has been expressed that there is no reference to smokeless zones in the Bill. From a practical point of view this does not matter, for the smoke control provisions are such that smokeless zones, as they have already been established, can continue to be set up in appropriate areas, and there seems to be no reason why these should not, outside the legal documents, be described as smokeless zones. This, we believe, will be valuable, for one of the merits of the smokeless zones campaign has proved to be the curious effectiveness of the phrase itself. It has somehow acquired that touch of publicity appeal or magnetism that commercial advertisers will spend fortunes to achieve, and which may be of the greatest propaganda value in the hard campaigns to come. Where a smoke control area is in fact a smokeless zone let it be spoken of as one!

By contrast, the phrase " smoke control area," is dull, vague and even misleading. Is not all Britain to become an area of more effective smoke control, and are not the smoke control areas, as defined in the Bill, really areas of special or priority control?

The Conference

The registrations for Bournemouth were well over the 500 mark by the middle of August, and a record conference is therefore ensured. An additional item to the programme as described in the last issue is that of an " Any Questions " session on the Wednesday morning. The " panel " will be the Rt. Hon. Alfred Robens, M.P., and Gerald Nabarro, M.P. Their subject—of course—the Clean Air Bill. Sir Ernest Smith will be in the Chair, and a most stimulating hour can be anticipated.

Not for Valhalla

Gas World, as quoted on another page, kindly concludes that the time has not yet come for the Society to fold its wings and fly to that Valhalla of outworn organizations. We fully agree with this view (apart from misgivings at the prospect of flying with folded wings) though not because the Bill does not provide for the setting up of a Clean Air Council, which is *Gas World's* reason. It was never expected that a body of this kind, the formation of which was proposed by the Society in its memorandum to the Beaver Committee, would require legislation. Little has been heard of it since the Report was published and accepted by the Government, and we hope that it has not been forgotten. We believe that the Council will, in due course, be set up and that it is

likely to be an advisory body of all interests concerned with air pollution, under a departmental wing. We do not think it is likely ever to attempt the day-to-day slogging kind of work done by the Society, some of which is outlined in a report described in this issue, and which could be most usefully expanded, here and now, if the funds were forthcoming.

C.B.E.

It was a pleasure and a satisfaction to see the name of G. E. Foxwell in the Birthday Honours as a Companion of the Order of the British Empire. Dr. Foxwell—though he needs no description to our readers in the world of fuel—is a distinguished fuel technologist and consultant, a Past-President of the Institute of Fuel, and a member of the Beaver Committee, to the report of which he contributed the much-discussed appendix on the availability of smokeless fuel. He has been a helpful friend of the Society for many years, although it is only just recently that he has become, as the representative of the Institute of Fuel, a member of the Executive Council.

Mote and Beam

Visitors to this country are apt to make remarks both adverse and (to us) peculiar. Among the most common of these are ironical comments by our American friends on the way we cling to the open coal fire.

But consider a report of a meeting convened to promote cleaner air, which speaks of a " stormy hearing, where the aroused crowd alternately cheered and booed the speakers." A report of a British meeting on proposals to do away with the coal fire, or set up a smokeless zone? Not at all. It is about a hearing before the Los Angeles County Supervizors on proposals to abolish backyard incinerators!

It seems that while some American municipalities have a refuse collection system like our own, the County of Los Angeles is among those which still relies on backyard incineration. Furthermore, the citizens defend them with might and main. The report goes on to say that the crowd " got so nearly out of hand that Chairman Herbert C. Legg called in three extra sheriff deputies to control the audience." Even the protagonists of the open coal fire cannot equal that.

Mr. Lauren B. Hitchcock, President of the Air Pollution Foundation of Los Angeles, sees the point. He says that a number of experts think that " the Los Angeles Basin, with its 1,500,000 archaic incinerators, rivals the unhappy rôle of London with its air pollution problem. One of the villainous rôles there was (*sic*) played by the traditional English open fire. In Los Angeles a growing number of persons are apt to defend the incinerator as a symbol of freedom. British ' tradition ' and American ' freedom ' deserve better symbols." Hear, hear, Mr. Hitchcock!

CLEAN AIR BILL WELCOMED BY EXECUTIVE COUNCIL

At a meeting on 28th July, 1955, the day following the publication of the Bill, the Executive Council of the Society passed the following resolution:

" *This meeting of the Executive Council of the National Smoke Abatement Society welcomes the publication of the Clean Air Bill and expresses its appreciation to the Government for so speedily having prepared such a comprehensive measure.*

" *Without necessarily endorsing all its details, to which further study is being given the Council regards the Bill as a very considerable advance on and consolidation of, existing legislation. It recognizes that the successful implementation of its provisions will depend largely on the manner in which they are operated by the local authorities and the Government departments concerned, and urges them to prepare at once to use them to the full.*"

THE CLEAN AIR BILL

An Outline of its Provisions

THE Bill, which describes itself as " a Bill to Make provision for abating the pollution of the air," follows very closely the recommendations of the Beaver Report. Its explanatory memorandum indicates its four main purposes:

(i) to prohibit the emission of dark smoke from chimneys, railway engines and vessels, subject to certain qualifications;

(ii) to prohibit the installation of new industrial furnaces unless they are capable, so far as practicable, of being operated without emitting smoke;

(iii) to require that the emission of grit and dust from existing industrial furnaces shall be minimized, and that new industrial furnaces burning pulverized fuel or large quantities of other solid fuel shall be provided with grit-arresting equipment;

(iv) to empower local authorities, by order, subject to confirmation by the Minister concerned, to declare " smoke-control areas," in which the emission of smoke from chimneys will constitute an offence.

The Bill also provides for the payment of grants by the Exchequer and local authorities towards the cost of converting appliances in private dwellings in smoke control areas; amends and extends the Alkali &c. Works Regulation Act; and provides for application to Crown premises and naval vessels.

An attempt has been made to describe the principal provisions of the Bill individually, as follows, in the reading of which, however, it must be borne in mind that such an outline means a certain loss of precision and detail. (Figures in brackets refer to the Clause or Section numbers).

Dark Smoke (1)

This provides that dark smoke shall not be permitted from a chimney of any building, except for periods to be specified by the Minister. It will be a defence to prove either that the contravention was due to lighting up a cold furnace, that there had been a failure of furnace or apparatus, or that suitable fuel was unobtainable.

Exemptions from S.1 (2)

Relates to a seven-year period in which it may also be a defence that contravention was due to the nature of the building or equipment and that it had not been possible to make the necessary alterations. Within this seven-year period the local authority may issue a yearly certificate confirming that this is the case.

Smokeless Furnaces (3)

It is required that no new furnace (other than domestic) shall be installed unless it is " so far as practicable " capable of continuous smokeless operation. If the furnace is installed in accordance with plans and specifications approved by the local authority it shall be deemed to comply with this requirement.

Grit and Dust (4) and (5)

All practicable means must be used in solid fuel burning furnaces to minimize grit and dust emission, and all new furnaces burning pulverized fuel or burning any other fuel and ten tons or more per hour, must be fitted with grit-arresting plant approved by the local authority. The Minister may direct that any local authority, or local authorities generally, shall refer any or all of such approval applications to him to be dealt with by him. A person dissatisfied by the decision of a local authority may appeal to the Minister.

Measurement and Information (6) and (7)

The Minister may make regulations requiring the making and recording of

grit and dust measurements, installing the necessary apparatus, informing the local authority of the results, and allowing the local authority to apply such regulations. (7) requires that information about furnaces and the fuel burned shall be given to a local authority, on written notice, if it is needed to enable them to apply the grit and dust provisions.

Smoke Control Areas (8)

This section allows any local authority, by order confirmed by the Minister, to declare the whole or any part of its district to be a smoke control area. It will be an offence to emit any smoke from any building in such an area, except that it will be a defence if the emission was caused by an authorized fuel. A smoke control area order may make different provisions for different parts of the area; may list its operation to specified clauses of building; or may exempt specified buildings or classes of building. The Minister may exempt any class of fireplace if he is satisfied that it can be used for burning fuel other than authorized fuel " without producing undue smoke." He may also relax or suspend the operation of an order to the whole or any part of a smoke control area.

Adaptation of Fireplaces (9)

Provision is made for the payment by a local authority of 70 per cent., or more if thought fit, of the cost of approved adaptations made necessary by a smoke control order. When the adaptations are made by a tenant and relate to appliances which can be removed, seven-twentieths of the expenditure shall be repaid until two years from the order coming into force, and after that any further repayment will be made only if the appliance has not been removed, and to the then occupier. The local authority may serve notices requiring adaptations to be made in a smoke control area, and if necessary may carry out the work themselves and recover three-tenths of the cost.

Exchequer Contributions (10)

The Minister may make grants to local authorities towards the expenses borne by them in connection with adaptations in smoke control areas, equal to four-sevenths of payments made to owners or occupiers, and to two-fifths in their own houses or executed by them.

(11) interprets the two previous clauses, and relates " adaptation " to adapting, converting or replacing fireplaces, installing other means of heating or cooking, altering flues or chimneys, and carrying out any incidental work. It also provides that if an appliance is being bought by hire-purchase the expenditure will be regarded as that which would have been incurred if it had been bought for cash on the date of the hire-purchase agreement.

Smoke Nuisances (12)

If smoke other than that from a private dwelling, or dark smoke, is " a nuisance to the inhabitants of the neighbourhood " it shall be deemed to be a statutory nuisance under the Public Health Act, 1936. Failure to comply with a nuisance order may lead to a fine of up to £10 and £5 for each day on which the nuisance continues. It will be a defence to show that the best practicable means to prevent the nuisance has been employed.

Special Cases (13)

The first part of this section provides that none of the preceding sections shall apply to premises controlled under the Alkali, &c. Works Regulation Act, but that that Act shall have effect in relation to smoke as it has to noxious or offensive gases. It is however provided that this shall not affect the operation of sections (1) and (12) (dark smoke and smoke nuisances) but that in England and Wales proceedings may be taken only with the consent of the Minister.

(13) (2) is a complexly worded subsection, which empowers the Minister not only to extend, but to vary and revoke the list of gases and works referred to in the Alkali Act (including the Scottish Act). In conjunction with (13) (1) this means that by means of an order the Minister may make smoke control in any specified cases a responsibility of the Alkali Works

Inspectorate, but also may remove any cases from such an order.

Colliery Spoilbanks (14)

This requires the owners of coal or shale mines or quarries to employ all practicable means for preventing the combustion of refuse and for preventing or minimizing the emission of smoke or fumes from the refuse. The Coal Mines Refuse Act of 1939, and the similar Act for Scotland, are repealed.

Railway Engines (15)

Section (1) (dark smoke) is to apply to locomotive engines as it applies to buildings, and the owner of a railway locomotive engine shall use any practicable means there may be for minimizing the emission of smoke. The railway smoke clauses of the Acts of 1845 and 1868 are repealed.

Vessels (16)

Sections (1) (dark smoke) and (2) (smokeless furnaces) of the Act are to apply to vessels as they do to buildings. The waters over which the section can be applied are those not navigable by sea-going ships, and those within any port, harbour, river, estuary, haven, dock, canal or other place in which charges can be made for vessels entering or using facilities.

Crown Premises (17)

This provides for the reporting by local authorities to the responsible Minister of emissions of dark smoke, grit or dust from Crown premises or under the control of a Government department, of any emissions from such premises in a smoke control area, or any which appear to constitute a nuisance to inhabitants of the neighbourhood. Premises occupied by a " visiting force " are to be regarded as Crown premises. Section (16) (vessels) is to apply to vessels owned by the Crown, other than naval vessels.

Miscellaneous Provisions

(18) provides that " building bye-laws may require the provision in new buildings of such arrangements for heating or cooking as are calculated to prevent as far as practicable the emission of smoke." **(19)** authorizes local authorities to undertake research, publish information and conduct publicity as to contribute towards the cost of these activities, while **(20)** is concerned with unjustified disclosure of information.

Penalties (21)

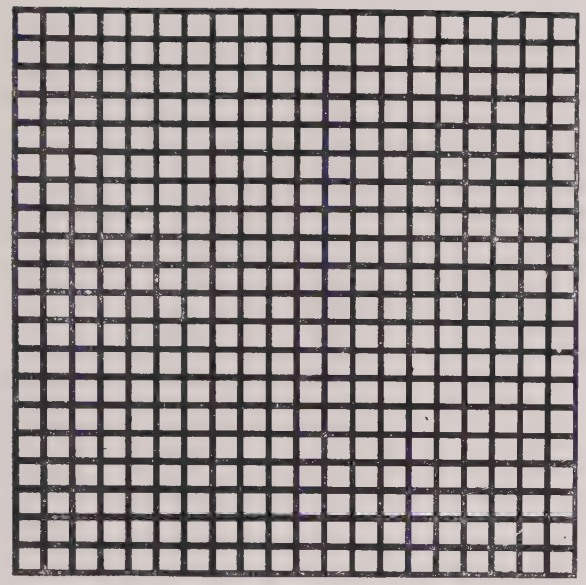
The maximum penalty for dark smoke emission from the chimney of a private dwelling is to be £10, and for any other chimney £100. For smoke emission in a smoke control area the fine will be up to £10, for disclosure of information under (20) £100, and up to three months' imprisonment, and for offences under any of the other provisions up to £100. If an offence is substantially a repetition or continuation of an earlier offence there may be a maximum fine of £100, or £20 for every day of the continued offence within the three months following the conviction—whichever is the greater.

The remaining provisions are of a technical or administrative character and need not be summarized here. Reference should however be made to the definition of " dark smoke " as " smoke which, if compared in the appropriate manner with the chart known at the date of the passing of this Act as the Ringelmann Chart, would appear to be as dark as or darker than shade 2 on the chart ". However, it is provided that:

> " For the avoidance of doubt it is hereby declared that, in proceedings brought under or by virtue of section one or section twelve of this Act, the court may be satisfied that smoke is or is not dark smoke as hereinbefore defined notwithstanding that there has been no actual comparison thereof with a chart of the said type. . . ."

Further, the Minister may by regulation prescribe any method of ascertaining whether smoke is dark smoke as defined.

Finally, it should be noted that the Act will apply to Scotland as well as to England and Wales, but not to Northern Ireland. A considerable number of smoke abatement clauses in earlier legislation are repealed.



"Ringelmann No. 2." This is the only shade in the chart referred to in the Clean Air Bill.

Some Observations

The introduction of a "dark smoke" standard means the end of the archaic "black smoke" limitation, although what periods of emission are to be permitted remains to be seen. Only shade No. 2 of the Ringelmann Chart, or its equivalent, will be required to be used. The seven-year exemption clause has already been criticized as being an unduly generous period of grace.

It will be noted that "prior approval" with respect to grit and dust from large and pulverized fuel plant is to be obligatory, but that with respect to smoke it still remains permissive, as in the recent local legislation (with the exception of the Preston Act).

The smoke control area provisions are given a flexibility that will enable smokeless zones, in fact if not in legal name, to continue to be established. This point is commented upon in our editorial notes, as is the special cases clause, which in the Bill is as was recommended by the Beaver Committee.

Section 18, allowing building bye-laws to require smoke abating arrangements for heating and cooking in new buildings, is a variation of the clause included in the Public Health (Smoke Abatement) Act, 1926, and at present in the Public Health Act, 1936, Section 104(2), which has never been implemented because, despite efforts, it did not prove possible to frame byelaws that would satisfy the Minister concerned.

COMMENT ON THE BILL

Press Approval

The Government's Clean Air Bill naturally received wide press publicity, which included a considerable amount of, on the whole, favourable comment. There was a general agreement that public opinion would be behind the legislation and that, although there were many problems still to be solved, the way was at last opening to cleaner, if not wholly clean, air. One of the most persistent queries was, of course: but where is the smokeless fuel, and where is it to come from?

From the sheaf of leading articles and other comment we have selected a number of extracts of particular interest and importance.

War on Smoke

If the air we breathe is to be made as clean as it might be the passing of the bill whose terms were published yesterday is only one action in a concerted campaign that must be resolutely waged on many fronts. Local authorities, the nationalized fuel industries, researchers and inventors, the British Standards Institution, business firms and private individuals, as well as the Government itself—all have a part to play. Between them, indeed, they can do far more to purify the atmosphere by voluntary action than could be done by the strictest enforcement of the most perfect legislation. But it is the Clean Air Act that will set the tone and temper of the campaign. For that reason, even more than for the sake of what

it can itself achieve, it is important that the bill should be made as near perfect as is humanly possible. Since it is in no sense a party measure, its present form may be regarded as a working draft, open to improvement without prejudice to anyone's political face. Viewed in this light, it can be welcomed unreservedly as a thoroughly good start.—*Manchester Guardian.*

Subsidy Justified

No subsidy was ever better justified than the contribution of at least 70 per cent. that will be made towards the cost of domestic equipment. To heat without smoke is to get the very utmost out of our basic raw material. Clean air is more than an end in itself; it is part of a co-ordinated fuel policy. —*Daily Telegraph.*

Progress Depends on Public Health Service

We must look on the bright side. After all the weary years of pioneering work by a minority, we have at last an agreed measure which should mean that within a period of years smoke will have ceased to be a menace to the health and cleanliness of the British people. The progress made will depend largely on the energy and persuasiveness of the Public Health Service and we are sure that the effort will not be grudged.—*Medical Officer.*

Air Fit to Breathe

Many local people have commented, during the past few weeks, on the remarkable clarity of the air. The combination of industrial holidays and an almost complete absence of domestic smoke over a wide area has certainly had an astonishing effect on the atmosphere. If only it could be like this all the year round!

The Clean Air Bill, the text of which has just been published, is the first really serious attempt to achieve something approaching that much-to-be-desired end. Many years may have to pass before anything like the full promise of the Bill is realized, but at last war is being declared on the smoke menace. And, as in other kinds of war, "we are all in this together." — *Halifax Courier and Guardian.*

Dangers of Exemption Clauses

How smokeless will the smoke control areas turn out to be? A great deal will depend on the use that is made of the exemption clauses. Generally speaking, exemption clauses do not serve the cause well. We know from our own pioneering experience in Bolton that when industry is given a special dispensation to flout the rules, public support for the whole idea begins to flop. It would be fatuous to try to pretend that these exceptions only go to prove the rule. Chimneys that smoke reduce smokeless zones to an expensive absurdity. —*Bolton Evening News.*

The Alkali Inspectorate

It is difficult to see how the alkali inspectorate would be able to carry out daily observation and constant contact with local industrialists. It is not clear why it should be thought that alkali inspectors have a practical knowledge of firing techniques and the know-how on mechanical stoking of particular plants, when in the past they have been concerned mainly with the chemical content of smoke and fumes. Clearly such officers could acquire the necessary knowledge, but this would take time. Also, the inspectorate is not large and would need to be considerably expanded to do work which is already well within the capacity of the specially trained officers employed by local authorities. Perhaps this point will be considered when the Bill reaches the amendment stage.—*Municipal Engineering.*

A Testing Time

Coke produced at gasworks should be sold at a price consistent with the service it gives, both from the thermal and smokeless-burning points of view provided always that it is a *reactive, free-burning fuel suitable for the open grate.* In other words, let the industry produce a really first class coke which will fulfil the requirements of the clean air legislation and then sell it at an economic price. As regards quantity, the limiting factor, of course,

is the amount of coal supplied to the industry. It is to be hoped that as the new legislation takes effect, coal at present being used inefficiently in industry and the home will be diverted gradually to the carbonizing industries where it can be processed with the maximum benefit to the nation. In the meantime, however, it may be possible to save some, or all, of the coke used in water gas manufacture by replacing the conventional carburetted water gas with a straight oil gas; it may also be possible to save for the domestic market the coke now burnt in producers, replacing this by low grade coal or even oil firing.

This is indeed a testing time for the gas industry—a time of considerable difficulty, but of equally great opportunity. The die is now cast and clean air is to become a reality instead of a pipe-dream.—*Gas Journal.*

Alkali Inspectorate or Local Authority?

We had come to hope that the Government would place responsibility for enforcement solely on local authorities but this is not to be, as the Bill stands. Smoke abatement in the heavy and so called "scheduled" industries would be the responsibility of the Alkali Inspectorate, as recommended by the Beaver Committee in its report issued last November.

Mr. Nabarro undoubtedly took the right course when he maintained in his own proposals that, where a local authority possessed the specialized technical facilities and officers, it should be permitted to do the work. One of the best examples of such an authority is Sheffield, which for years has played a leading part with its investigation and control of industrial pollution. It would be folly to make trained smoke inspectors redundant. Despite this defect—which may be rectified by Parliament—the Government's Clean Air Bill is a substantially good one and undoubtedly worthwhile.—*Municipal Journal.*

Controlled Smoke Control

The Government has obviously been listening to the critics in framing the Clean Air Bill. Held up against the Ringelmann Smoke Chart it comes out a lightish grey. Householders certainly have somewhat less to fear from it than they had from the Beaver Committee report, largely because, though local authorities will be empowered to declare smoke control areas, in which it will be an offence to emit smoke subject to certain exemptions, the power to confirm the order will remain with the minister; and by now the minister seems to have grasped the fact that smokelessness depends on the supply of smokeless fuel.—*The Economist.*

Legislation Not Enough

A perusal of the Beaver report indicates that legislation alone cannot bring about the desired result. About half the recommendations of the committee related to subjects not entailing legislation. It will be necessary, for example, to make supplies of smokeless fuels more abundant, there is need for further research into the removal of sulphur from fuels (the Bill makes no reference whatever to sulphur and sulphur dioxide, serious pollutants though they are), local authorities will require larger and well-trained smoke-control staffs, industry should be encouraged to employ trained stokers, railway smoke is only likely to be reduced by the extension of electrification and so on. Vigorous action will be essential to implement these and other similar recommendations. If it is not forthcoming, whether or not we have a Clean Air Act, we shall never have clean air.—*The Engineer.*

Valhalla not for the N.S.A.S.

There have been some who have declared that with the passing of this Bill, the National Smoke Abatement Society can fold its wings and fly to that Valhalla in which outworn bodies rest that have done their work and are no longer needed. We do not subscribe to that view. On the contrary, the very fact that the progressive ordering of smoke control areas is left to local option means that the Society should revitalize itself to embrace the further work of propaganda among local authorities that it must now

(*Concluded on page 25*)

THE WORK OF THE SOCIETY

A Recent Report

The Executive Council, at a recent meeting, considered a report from the Director on the various activities carried out at the Society's headquarters offices. The Council asked for a digest of this report to be prepared for *Smokeless Air* because of the interest it would have for many members.

The report arose from consideration of the Society's perpetual difficulty of having a programme that is always much bigger than the resources needed to carry it out. " Resources " means income, but it includes of course the staff and ability to make use of outside facilities and services that income alone makes possible. The annual income has only just reached the £8,000 a year level and this includes a number of special short-term subscriptions that may soon come to an end. The staff, six in all, consists of the Director, Assistant Secretary, Information Officer, Accountant, and two Secretarial Assistants.

The report lists the various activities under 20 main headings, beginning with the business and administrative work and going on to what it calls the functional activities—those which directly promote the Society's objects,

Points from the " business " items are that in 1954 the number of items posted was over 30,000, including 2,500 individually written letters. The mailing list, as shown by the Addressograph plates, totals 4,300. Income and expenditure items totalled 3,000, and there were over 700 separate bookselling transactions. Other business and administrative activities include Executive and Committee work, the annual elections, the advertisements side of *Smokeless Air* and *Year Book* (which it will be noted is expanding), and the organization of the annual conference.

Then, partly business and partly policy, comes the editorial work and publishing of *Smokeless Air*, the *Year Book*, the Conference *Proceedings*, and the occasional leaflets and pamphlets.

Press publicity is another item of importance, the work done on which is always well worth while and sometimes remarkably good. For the 1954 conference at Scarborough, for instance, 479 cuttings were received. The press mailing list includes 240 newspapers and periodicals.

Next in the report are activities that help in other ways to promote the Society's aims, frequently by providing a service that is used, not only by members, but by many others—teachers, journalists, research workers, local authorities, government departments, industrialists, householders and overseas inquirers. Item headings in the report include *Library and Intelligence*, *Photographic Library*, *Exhibitions*, *Inquiries*, *Lecture services*, *Liaison*. Mention is made of the difficulties that have been caused to the library and information sector by the enormous increase in interest in air pollution during the last few years—one indication is the jump in press cuttings from an average of 60 a month in 1947 to over 1,000 a month in 1954.

We believe we have the best general collection in the country of air pollution photographs, and there is a constant demand for the use of these for reproduction, exhibition work, lectures and so on. Up to 100 prints have been out on loan at one time. (Efforts are being made at the present time, through an appeal in the photographic press, to secure further first-class pictures).

In present circumstances the Society can only rarely take, equip and man a stand at exhibitions, but its small collection of transportable exhibits are in frequent demand and since 1949 they have been loaned to an average of 22 exhibitions a year in all parts of the country (mainly local authority exhibitions).

The paragraph in the report on " Inquiries " may be quoted in full:

" Much staff time is taken up by correspondence, telephone calls, and callers at the office, largely from outside the Society's membership. The range of subjects raised is wide and includes, for example, complaints of smoke nuisances, inventors and inventions, advice on domestic heating matters, propositions from salesmen, references to publications, technical information, general information for journalists and students, photographs, literature, etc. The growth of this work is an encouraging indication that the Society is becoming better known, and is to be welcomed as a service for which it exists. With so small a staff, however, telephone and personal calls can, and frequently do, interfere with more urgent work."

In conclusion the report says that the purely administrative work is fairly satisfactory, but that all the " functional " activities could be improved and considerably developed. " In particular more attention needs to be given to library organization, exhibition materials, preparation of new publications, visual aids, lecture organization, advertising promotion for *Smokeless Air* and *Year Book*, membership appeals, press publicity (correspondence, etc.)."

" With so small a staff," continues the report " it is impossible to develop further in any one direction without having to contract in another, and it is only by more staff, which calls for more income, that the present situation can be made more satisfactory and a start made on the many developments that are desired."

Ample work is said to be waiting for at least two further administrative officers and corresponding clerical assistants, and it is estimated that " in work such as the Society's the cost of each more senior officer, plus secretarial and other costs resulting from his activities, may be reckoned at £1,000 to £1,500 a year ".

Finally, the report emphasizes " the importance of giving priorities to the many activities that might be undertaken, and then concentrating on those selected as of greatest importance or as most profitable. From this it follows that activities of lower priority, even if they have much to commend them, may have to be forgone altogether. In publicity matters especially it is normally preferable to concentrate effort over a limited field than to disperse it in too many directions so that it becomes weak and less effective ".

Compared with the larger organizations the Society's efforts will seem very modest, if not puny, but there is a satisfaction in believing that the work done and results achieved, per each £1 expended, will compare favourably with any.

Comment on the Bill

—*concluded from page* 23

undertake. Had this Bill contained provisions for a Clean Air Council, the N.S.A.S. might not have been needed; as it is, there is still much work for it to do, and we shall expect its work to be necessary for at least another 10 or 20 years. After that, who knows? The Society, however, henceforth has a specialized part to play, mainly among local authorities. It has done sterling work throughout its life and this Bill, even though the off-spring of an independent committee unconnected with the Society, is in fact the culmination of these years of work. But from now on its advocacy should be assisted more powerfully than ever before by all engaged in fuel industries—perhaps excepting the few who still live in the raw coal age!—and the publicity departments of these industries must surely seek to place before the people of this nation a realistic account of the blessings of clean air. There is 10 or 15 years of hard and rewarding work ahead of us all to achieve fully the clean air that is now within our grasp.—*The Gas World.*

AN EFFECT OF GAS WASHING AT BATTERSEA POWER STATION

by

R. S. Scorer

Imperial College

The Beaver Report recommends, in spite of weighty arguments which it admits but makes no pretence to refute, that gas washing should be installed at power stations, and it may be that Parliament will be asked to enforce this recommendation. I have already discussed some of the arguments in the papers referred to below: the purpose of this note is to give, by way of illustration, an example of one of the worst effects of gas washing.

When the wind is strong the plume from a chimney stack is greatly diluted and no serious pollution at the ground is caused by tall chimneys. When the wind is light—less than about 10 m.p.h.—gases reaching the ground may be of objectionable concentrations if they descend close to the station. The gases of the washed plume have a negligible buoyancy and pass away from the chimney top almost horizontally; while those of the adjacent untreated plume rise at an angle of anything between 5° and 30° to the horizontal on account of their buoyancy, and probably give rise to no objectionable concentrations anywhere. The washed plume loses enormous amounts of heat as it mixes with the surrounding air on account of the evaporation of the liquid water droplets suspended in it,



Battersea Power Station viewed from across the river on an occasion when the washed gases from the SW stack were descending on to the river surface. The gases from the SE stack, which were unwashed, rose at an angle as shown in the diagram and produced no observable pollution at the ground anywhere. (10.45 *a.m.* 7 *June*, 1955).



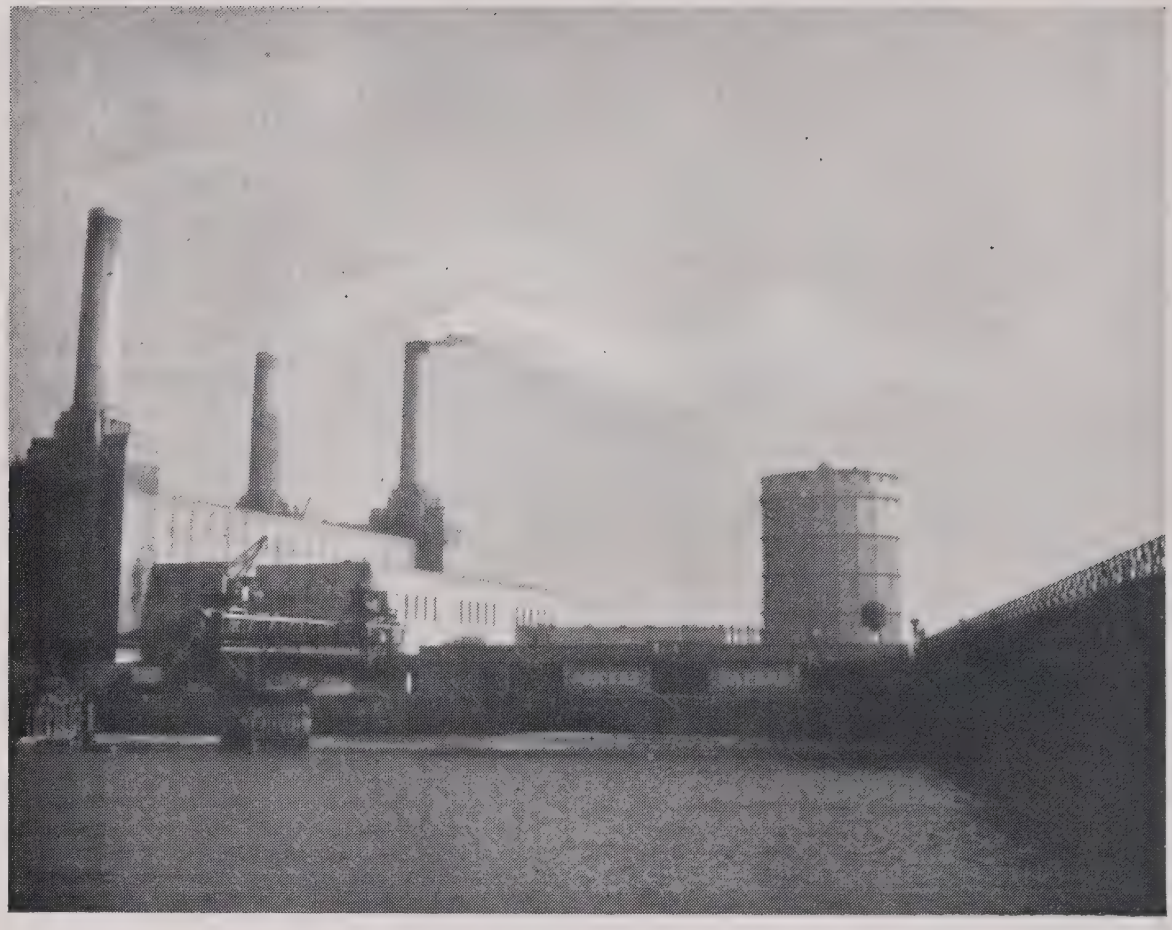
This shows Battersea Power Station viewed from Vauxhall Bridge. (Owing to the greyness of the sky the photograph on which this is based gave too little contrast to the unwashed plume for satisfactory reproduction here). At the moment illustrated the washed plume is about to be caught in an eddy and carried down on to the river surface to produce the effect shown in the photograph. (10.35 *a.m. 7th June*, 1955).

which, incidentally, are responsible for the white appearance of the plume. In consequence of this loss of heat the gases acquire a negative buoyancy and begin to descend.

Soon, (in the case illustrated this was before they had reached the other end of the power station) they come under the influence of the wind variations caused by eddies round the power station itself and other large features of the neighbourhood. In the case illustrated great clouds of blue smoke were descending to the river surface so that when viewed from the north bank the power station was almost completely obscured. This is not an easy phenomenon to photograph because tenuous clouds of blue smoke does not stand out against its environments and is noticed chiefly by its movement and its colour. In this photograph however, the power station is obscured by its own smoke issuing from the SW stack (the distant right hand one) while the crane on the river bank and the more distant gas holder can be clearly seen. A few minutes earlier the outlines of the washed and unwashed (SE stack) plumes were observed from Vauxhall bridge to follow paths as indicated in the diagram. (A photograph from which this diagram was constructed gave too little contrast between the unwashed plume and the grey sky for it to be reproduced satisfactorily here). After taking the photographs I cycled towards Victoria Station and could see these clouds of smoke passing *in among* the new blocks of flats and old streets of Pimlico.

The argument in favour of gas washing is based first upon the assumption that sulphur dioxide in the amounts produced at a large power station are obnoxious and then upon the assumption that a process which removes 95 per cent of it must be beneficial. In the event, because the washed plume descends to the ground so close to the station, even if 95 per cent were removed, which it is not, the concentration of sulphur dioxide at the ground is much greater than if no washing has been performed.

Throughout the long arguments about who is the chief villain in poll-



The plumes from Battersea Power Station on another occasion. The whiter washed plume is sinking slowly, and when seen from some distance downwind obscures the top of the chimney. The other ascends at an angle of about 30° at first. On this occasion the unwashed plume is passing about half a chimney height to the far side of the stack producing the washed plume, so that its altitude relative to the washed plume is reduced for this observer.

uting the atmosphere almost no attention has been paid to the manner in which the pollutants are emitted while statistics of total amounts have been freely bandied about. Thus one shunting yard or an old factory can do more harm by pollution than a large power station consuming a hundred times the fuel daily. This may be plainly seen at Fulham, where the power station probably does not produce any pollution *at the ground* within a mile or more, and yet the neighbourhood is dirty and smelly on account of gas works, tugboats, small industries and railway yards.

References: R. S. Scorer "Smog" Science Progress No. 167, p.396, July, 1954. "Plumes from Tall Chimneys" Weather 10, No. 4, p.126, April, 1955.

Domestic Heating—A Special Study

A comprehensive conference on "Domestic Heating in the United Kingdom—Present and Future," to be held in London next May, is being organized by the Institute of Fuel. The main sections, each with a number of papers, will be on Fuels and their Production, the Provision and Design of Appliances, and Design of Dwellings. Papers will be included on the development of smokeless zones and practical steps to be taken in setting up smoke control areas. We hope to publish further details in our next issue of what should prove to be a most important study.

Obituary

LADY SMITH

It is with the deepest regret that we record the recent death of Lady Smith, the wife of our President. Lady Smith shared her husband's interest in the work and progress of the Society, and was with him at the inaugural conference at Buxton in 1929, and at many of the conferences since then. Those who knew her know what a friendly and delightful personality she had, and how much, and how helpfully, she was a partner in her husband's many interests and activities. All members of the Society will wish to be associated with the expression of sincere sympathy that we extend to Sir Ernest.

LORD HORDER

We regret to have to record the death on 13th August, 1955, of the President-Elect of the Society, Lord Horder. We had all been looking forward to his presence at the forthcoming Bournemouth conference, when he was to be declared President, and at which he had agreed to give a special address. This would have been one of the most important high-lights of the meetings. Lord Horder's standing in the field of medicine, and indeed over a far wider sphere of public affairs, was such that his Presidency at the present time would have been a signal honour and inspiration to the Society —especially as he had told us, characteristically, that it was not his way to take on an office as a mere figurehead.

DR. STUART LAIDLAW

It is also with deep regret that we pay tribute to Dr. Stuart Ian Alexander Laidlaw, Medical Officer of Health for Glasgow, who died recently very suddenly. Dr. Laidlaw was a firm and thoughtful supporter of smoke prevention and of the Scottish Division of the Society, at one of the annual conferences of which he read an outstanding paper on smoke and health. Dr. Laidlaw, who was 53, first joined the Glasgow Health Department in 1929, and was appointed M.O.H. in 1945. For his work—which included the introduction of mass radiography in the city—he was made an Officer of the Order of St. John of Jerusalem. Our sincere sympathy is extended to Mrs. Laidlaw, who always accompanied her husband at the conferences in Scotland.

The New South Wales Government has appointed a 17-man smoke abatement committee. Members will investigate the causes, extent and effects of air pollution in New South Wales' cities and recommend preventive measures.

Oil Films

We have received a copy of the catalogue of films contained in the film library of Shell-Mex and B.P. Ltd. (Shell-Mex House, London). The number is surprisingly large and so is the range of subjects covered—the main subject headings being petroleum, industrial and engineering, agriculture, aviation, motor sport, and miscellaneous. Those of the films we have had the opportunity of seeing are of very high quality and interest. The films are available on loan to interested bodies, provided that no admission charge is made when they are shown.

Among various reports and other publications received recently from the United States of America are the May, 1955, issue of the Journal of Air Pollution Control Association (*Air Repair*) containing the papers read at the first semi-annual Technical Conference, held at Los Angeles in November, 1954, and the first Technical Progress Report (Report No. 4) of the Air Pollution Foundation of Los Angeles.

Smethwick Town Council has decided to invite local manufacturers to join them in a new effort to make Smethwick smokeless. They have agreed to set up a panel to examine plans for new furnaces submitted by manufacturers and hope representatives of the manufacturers will sit on the panel.



From our Photo-Library—23 *W. Jackson*

DOCKS

Consultative A.P. Committee for St. Pancras

First in the London Area

A Consultative Committee on Air Pollution, similar to those established in a number of towns in Lancashire and more recently at Smethwick has been set up by the St. Pancras Borough Council, to assist it to explain and elaborate its policy and actions on air pollution. In addition, the Council has set up a Standing Committee on Air Pollution, on which only Council members sit, and to which the Consultative Committee reports. The Standing Committee may then report to the Council.

The Consultative Committee, which held its first meeting on 29th June of this year, consists of representatives of about 24 organizations in the Borough, and a number of sub-committees, with the appropriate representatives on each, have been set up: domestic, railways and transport, effects of air pollution, and industrial. The bodies co - operating include women's and old-age pensioners' associations, residents' and tenants' associations, trade unions, the N.C.B., C.U.C., Gas and Electricity Boards and the Chamber of Commerce.

The sub-committees are reported to be making good progress in their initial task of gathering information from official sources and from the individual experience of the members. The Hon. Secretary is Mr. J. E. Whitelegg, who is Fuel Overseer for the combined area of Hampstead, St. Marylebone and St. Pancras, and whose address is the St. Pancras Town Hall, Euston Road, London, N.1.

THE DIVISIONS

The **Yorkshire Division** met for lunch at Hull Guildhall on 8th June. The members were welcomed by the Lord Mayor (Alderman W. Fox), who told them of Hull's practical interest in smoke abatement. " The City Council," he said, " is in advance of public opinion on the matter of smoke prevention, for it is not long since a town's meeting, very unwisely in my opinion, rejected a smokeless zone provided for in our last Parliamentary Bill."

Mr. Saword, Hull's Chief Sanitary Inspector, in thanking the Lord Mayor for his hospitality, said, " We can only feel that the adverse decision was resolved on insufficient information, because the opposition came largely from property owners, and if property owners were aware of the full facts of the matter they could not help realizing that smoke does an enormous amount of damage."

Mr. Saword also said that when the public heard of societies which were " anti " this or that, they were inclined to regard the members as biassed. This could not be levelled against the N.S.A.S., whose membership comprised members of local authorities, together with all large public utility undertakings.

After lunch the party enjoyed a tour of the new Ellerman Wilson liner *s.s. Cicero*.

A most instructive visit was paid by members of the **East Midlands Division,** on 19th May, to the works of the Appleby-Frodingham Steel Company at Scunthorpe. The party gathered in the morning in the attractive exhibition building at the works, where working models of the processes in the making of iron and steel were clearly and impressively demonstrated. A tour of the works, assisted by motor coaches, was then made, beginning at the ore preparation and sintering plants. The blast furnace plant, melting shop (steel making in tilting open hearth furnaces), rolling mill, and the central engineering workshop were also inspected. Luncheon, as guests of the Company, at a hotel in the town was followed by an address by Mr. Neil Turner, on " Air Pollution in Relation to the Manufacture of Iron and Steel." This was followed by a number of lively questions and discussion.

The works—the built-up area of which is 1,150 acres, with about 10,000 employees—had obviously a number of air pollution problems to contend with, but there was much evidence of these being tackled with imagination and determination.

The East Midlands Division also met at the Stanton Ironworks on 7th July. The members were welcomed by Sir Frederick Scopes (Managing Director) and Mr. Watson (Director). In the course of his speech Sir Frederick stated that the company were now spending £4½ million on new blast furnaces and coke ovens. Much of that expenditure was directed to smoke abatement and the reduction of atmospheric pollution generally. The firm had been pioneers in substituting diesel locomotives in place of steam locomotives and eight diesel locomotives had been supplied at a cost of £120,000.

The Chairman, Mr. T. H. Turner, replied and thanked the Directors for their welcome and for permitting the meeting to be held there. The Annual General Meeting then took place. The officers for 1955-56 were then unanimously elected, as follows: Chairman, Alderman S. Cooper; Deputy Chairman, Councillor J. E. Swain; Hon. Secretary, Mr. A. Wade; Hon. Auditor, Mr. H. N. Eardley; Scrutineers, Messrs. V. Wales and Councillor Mead. Councillor Mead expressed the thanks of the meeting to the retiring officers.

On completion of the A.G.M. a film was shown illustrating the manufacture of Stanton pipes. After lunch, which was provided by invitation of

the Company, members toured the concrete plant and the spun plant.

The **North West Division** held its Annual General Meeting at the Town Hall, Manchester, on 10th June. The annual report, presented by the chairman, Mr. H. V. Cass, stated that if the recommendations of the Beaver Committee were adopted and carried out vigorously and speedily, the atmosphere of our towns could be appreciably improved within ten years. Greater emphasis could have been placed on the need to design and build a new fuel policy and price structure, " for herein lies the very crux of the problem."

A talk was given by Mr. A. Fitton, principal scientific officer of the Fuel Research Station, Greenwich, who said that there was nearly half as much smoke from vehicle exhausts on the roads of Great Britain as from domestic fires. Mr. Fitton suggested a number of remedies including: first-class maintenance of engines and fuel systems in our garages and workshops would go " a long way " towards reducing the pollution from diesel engines. For petrol engines there must be an adjustment of carburettor for a leaner mixture of fuel and air, and improved distribution of the mixture in each cylinder.

Mr. Fitton asked for moderation when starting up a cold diesel engine or going up a long steep hill. Again, the extra-rich mixture from an overworked engine would send out clouds of filthy black smoke.

He suggested that engines should be controlled so that they could not be driven at over 90 per cent. of their maximum rating. This would reduce the black smoke from the exhaust by half. There should also be a cleaner in the exhaust line.

Other suggestions were for development of the pre-combustion chamber type of engine, using diesel oil with a small proportion of petrol, and the use of catalysts and after burners for reducing the smoke.

The Division held another meeting on 2nd September, when the members were guests of the Northern Electricity Board. Visits were made during the morning to Leslie & Godwin Ltd., to see converted electric storage heating system, to Lookers Ltd., to see floor heating installation at their showroom, and to Tottington Church, where a tubular heating installation is in existence. After lunch a visit was made to Blackburn Cathedral to see electrode boiler heating installation. After this visit a meeting of the Divisional Council was held at Blackburn Service Centre.

The **South East Division** met at Oxford on 19th May in the City Council Chamber. The speakers were Dr. A. R. Meetham, D.SC., of the National Physical Laboratory, and Mr. A. G. Ludgater of the solid Smokeless Fuels Federation.

Dr. Meetham said in the course of his talk that sulphur pollution could be reduced by 15 per cent. if all coal were washed. This prompted Professor G. M. B. Dobson, University Reader in Meteorology, to comment: " I cannot understand why washing coal isn't made compulsory. We should try to ensure that all coal is washed."

Earlier, Dr. Meetham said it was right that the national effort should be concentrated on preventing pollution of the air by smoke, because prevention of pollution by sulphur dioxide needed special techniques and not enough was known about it. " We now know what it is and where it comes from, but we are still in doubt about where it goes and how it can be helped on its way." From experiments conducted at Leicester it appeared that wind by itself was not enough to lift the sulphur-dioxide from the ground, but natural processes tended to remove it about three times as fast as smoke was removed from the atmosphere.

During his talk, Mr. Ludgater said that in recent months there had been a substantial increase in supplies of smokeless hard coke, but it would take time to make available supplies

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A SMOKELESS ZONE ADVISORY CENTRE

City of London Publicity

From 2nd October the City of London will be a smokeless zone, created by the City Corporation under its powers granted in the City of London (Various Powers) Act, 1954. In order to help property holders in the City, the Corporation established an advisory centre, which was open from the 11th to the 22nd July. This was housed in marquees sited round the City's Information Centre at the St. Paul's end of Cannon Street.

The centre was opened by the Lord Mayor, Sir Seymour Howard, who recalled that in December, 1952, 4,000 people in London died of the effects of "smog." The City Corporation felt that the emission of smoke should be prohibited by law and sought powers to establish a smokeless zone. "It might be wondered," the Lord Mayor said, "why we have done this while similar action has not been taken in adjacent areas. But this city has ever been in the van of all wise and beneficient movements, and I hope our neighbours will soon follow our lead."

The city is in many ways an ideal area for London's first smokeless zone. There are fewer than four thousand registered users of domestic coal, and already a considerable proportion of heating is by gas or electricity. While so many new buildings are in the course of erection or planning, it is advantageous to have a clear legal ruling which will save later structural alterations. This smokeless zone may well be the last established under the present rather cumbersome legislation,



Sir Seymour Howard, Lord Mayor of London, opening the City's Smokeless Zone Advisory Centre. Sir Hugh Beaver, who also spoke, is on his left



A General View of the Advisory Centre

which requires local authorities to seek powers from Parliament.

In the marquees at the advisory centre were exhibits of apparatus and appliances by the British Oil Burner Manufacturers' Association, the Coal Utilisation Council, the Combustion Engineering Association, the London Electricity Board, the North Thames Gas Board, and the Solid Smokeless Fuels Federation. The last named display was staged in the mobile exhibition van familiar to many of our readers. The National Smoke Abatement Society co-operated by means of exhibits, posters and a book-stall within the Information Centre itself, and by producing a special " take away " leaflet for the occasion —briefly entitled " 1306 to 1955." It is estimated that about 5,000 people attended the centre.

The Divisions

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in small quantities at the household level.

After the meeting there was a Mayor's reception and lunch, during which the members were welcomed by the Mayor, Councillor Marcus Lower. The Mayor was thanked by Dame Vera Laughton Mathews. In the afternoon a visit was paid to the Morris Motor Works, especially to inspect the excellent system used for the prevention of pollution in the paint spraying operations.

A woman speaker at a New York air pollution meeting has made an unusual appeal for action. "Women," she said, " are now almost completely clothed in nylon. If their stockings can be disintegrated by this city's sulphur fumes, why can't all the rest of their clothes? For decency's sake I appeal to you to get sulphuric acid out of the air."

THE CLEAN AIR PROGRAMME AND THE GAS INDUSTRY

In his Presidential Address to the Annual General Meeting of the Institution of Gas Engineers at Southsea on 24th May, Mr. W. K. Tate (General Manager, Eastern Division) Southern Gas Board) spoke about the Beaver Report and the consequent Government action—" action which cannot but present our Industry with tremendous opportunity and equally great responsibility."

Mr. Tate considered that the coal supply prospects for the gas industry in the future were such that hope lay largely in the gasification of fine coal, with perhaps developments in the gasification of oil. He continued: " Holding the views already set out, it is but natural that I cannot think that there will be a large building programme of new carbonizing plants to cater for gas making coals diverted from their present uses, both because of uncertainties in the economics of disposing of gas outputs, and because of future difficulties in the supply of appropriate coals at satisfactory prices and qualities. What then can be done with existing techniques?"

Examining the situation, Mr. Tate tentatively estimated that up to an extra 9.6 million tons of coke might be provided for the domestic market by the industry—nearly half of which would come from the withdrawal of coke from industry. Such results, however, depended on a continuing availability of high quality gas-making coals, upon which long-term reliance was unwise. He continued:

" Hand in hand with the development of complete gasification processes, the industry should turn its attention to the manufacture, as such, of solid smokeless fuels, an activity to which the National Coal Board is devoting such energy at the present time, and of which it has been said the primary source must be the high volatile non-caking coals. . . . Gas Boards have statutory obligations governing the supply of gas, and although these do not apply to coke, yet there is a growing feeling of duty to the public and a wish to ensure that those who require coke shall receive it. Such an evolution is commendable in the extreme, and befits an industry that has always placed service to the consumer first, but times are changing and demand is growing. It behoves us, then, not to ignore the future and find ourselves dependent more and more upon a commodity which is manufactured, and is subject to heavy peak demand, while the production and distribution of the fuel which can ease our burden here passes into other hands."

Bats

Mr. Tate frankly discussed one frequently-voiced complaint about coke. " A major objection to coke," he said, " frequently arises from the presence of ' bats ' or small pieces of shale, that split and fly violently apart in use, and these, being usually separate from the coke substance, are capable of being removed by suitable cleaning equipment at the gas works, always provided that the National Coal Board cannot furnish coal that is adequately treated beforehand. With an increasing diversion of coke to domestic uses the installation of cleaning facilities for the removal of this shale has, I suggest, become a matter of prime importance, and no new grading plant of substantial output should be constructed without a provision in this regard. Even so, we must constantly deplore the receipt by the Gas Industry of coals with a high general ash content, since these must give a less satisfactory coke, and little relief could be expected by the blending of coals so supplied, since the necessary fine crushing can only lead to an increased ash disseminated throughout the coke body."

A Trio of Fuel Reports

N.C.B. N.I.F.E.S. F.R.S.

These three reports all contain material of importance to the clean air campaign, and demonstrate in their various ways how much is now being done for the better utilization of fuel, the production of smokeless fuels and the investigation of the pollution problems that are still outstanding.

The **REPORT AND ACCOUNTS OF THE NATIONAL COAL BOARD, 1944,** (H.M.S.O., 7s. 6d.) has a number of references to the part the Board can play in helping to implement the recommendations of the Beaver Committee. These, says the report, " would oblige domestic consumers in the " black areas " to use fuels which give off little or no smoke in the place of the bituminous coal they now use. Production of the naturally smokeless coals such as anthracite and dry steam coal is expected to increase only a little, and slowly, over the next 10 years. Thus, even allowing for more use of gas, electricity and oil and for some rearrangement of present supplies of solid smokeless fuels to the advantage of the " black areas ", a large amount of additional smokeless fuels would be needed.

" In the closing months of 1954 the Board were considering the implications of the Beaver Committee's Report. The Committee look to the gas industry to supply the bulk of this extra fuel in the form of improved coke. If this were to be the source of supply, the Board's main task would be to arrange the supplies of coal as to divert to the gas industry the maximum quantity of coal suitable for making gas and improved coke, both smokeless fuels that can be used in the home. The Board themselves produce large quantities of coke and 331,000 tons of " Phurnacite " (and sold 48,000 million cubic feet of gas). But over half the coke they produce is metallurgical coke on which the iron and steel industry depends and there is limited scope, with their present plants, for them to expand production of established types of smokeless fuels for domestic use."

However, in discussing research and experiment, the Report states that the possibility of making more smokeless fuels is a major objective of the research effort, and much was done in 1954 to develop both new and existing processes for increasing the supply of them. There are two main lines of attack. The first is to modify current coking plant practice to make improved kinds of coke, and the second is to find ways of making smokeless fuel from coals which contain much volatile matter and which, being non-caking, cannot be turned into coke.

The Report continues:

Two sets of experiments based on known techniques began during the year on the production of reactive domestic coke. In one, a blend of low rank coal and carbonization coal was carbonized in normal coke ovens at the normal high temperature and it was found that, if the blend used is of low enough ash content, a coke suitable for modern grates can be made. In the other, normal carbonization coal was carbonized in narrow ovens at medium temperatures. Results showed that coke suitable for use in old fashioned grates can be made. The economics of both processes remain to be determined and the experiments are continuing. If successful, they will have the advantage that some existing plants can be adapted to use them.

New Smokeless Fuels

The Board's research into ways of increasing the supply of domestic smokeless fuels by making new fuels from coals which are unsuitable for

making either coke or established manufactured fuels, has hitherto been based on the need to use the constantly increasing proportion of small coal produced by modern mining methods.

This research culminated, in 1954, in the discovery of a novel process. A small 50 pounds an hour plant was designed and successfully operated which removes the volatile matter from small coal by heating it in a fluidized state and makes the remaining chars into briquettes by binding them with pitch derived from the coal itself. The pitch is, of course, smoke producing and the third stage of the process is to make the briquettes smokeless by passing them through a new type of carbonizer which uses hot sand.

Progress was also made with another process by which carbonized briquettes are made from slightly caking coals which have been oxidized. Operation of an experimental plant to oxidize one ton of coal an hour began during the year.

Much work has still to be done to determine the practicability on a large scale, and the economics, of both these processes. Account must be taken of the capital cost of new plants, the value of the by-products and the potential markets for them.

But if domestic coal in the "black areas" is to be gradually replaced by smokeless fuels, any new process for making those fuels must be designed to take the smoke out of domestic coal, much of which is large.

Such a change in the size of coal to be used for these new fuels would not invalidate the new processes, though the possibility of having first to crush the large coal would be another factor to be taken into account when considering their economics.

During research into the production of new smokeless fuels, the problem of binding small coal, whether in its natural state or derived from crushing large coal, to form briquettes has constantly been studied. One process described above uses pitch as a binder but this adds to the cost and also demands the third stage in which the pitch is made smokeless. During the year, the Board's scientists discovered a simple way of forming small, non-caking coals into briquettes without a binder. The briquettes produced are strong and, when carbonized, make very strong smokeless fuels. This process is only at the laboratory stage and there may be difficulties in applying it on a large scale, but if it succeeds a major step forward will have been taken.

THE FIRST ANNUAL PROGRESS SURVEY OF N.I.F.E.S. (the National Industrial Fuel Efficiency Service) is an encouraging document to all who have fuel conservation at heart. The organization was incorporated on 2nd December, 1953, as a non profit making company under the Companies Act of 1948.

This creation of industry's own Fuel Efficiency Service to take over and expand the work of the Fuel Efficiency Department of the Ministry of Fuel and Power was the culmination of a series of inquiries and reports extending over a number of years and concluding with the Pilkington Committee which reported in March, 1953.

In accordance with the recommendations of that committee the British Productivity Council became the sponsoring body and nominated the Directors. Thereafter, N.I.F.E.S. became an independent body under the sole control of its Boards of Directors.

The company can draw on the National Coal Board for annual contributions up to a maximum of £250,000 per annum and on the Gas Council and the Central Electricity Authority for up to £100,000 each per annum for a period of five years from 1st April, 1954.

From the date of incorporation until well into the Autumn of 1954 problems of staffing and of premises were a serious preoccupation, but as soon as the principal officers had been appointed things began to move at speed. It was found that most of the engineers and other staff made available for transfer by the Ministry of

Fuel and Power were keenly interested in the possibilities opened up by the new organization and welcomed secondment. In all 126 engineers transferred.

The Survey shows that in spite of the difficulties inherent in so drastic a change as that from a government department to an independent concern N.I.F.E.S. was, nevertheless, quickly off the mark. Organization was planned to give the maximum service to industry with the resources available and the regional pattern of a government service was modified accordingly. There are now nine Area Offices and six Sub Offices. The ninth, which has only recently been added, is at Belfast, the government of Northern Ireland having invited N.I.F.E.S. to extend its service to industry there on terms which maintain the independence of the company and satisfy conditions peculiar to that area.

Heat and Power Surveys

The degree of acceptance of N.I.F.E.S. by industry can be judged by the fact that even in the short time that has elapsed Engineer time spent on Heat and Power Surveys has increased fivefold. In May, 1954, the number of Engineer days recorded under this head was 256. Eleven months later the monthly total was 1,671.5.

Another result of the confidence placed in the new organization is the demand by fuel users for a continuing association with N.I.F.E.S. Over 70 firms have concluded regular service agreements under which N.I.F.E.S. Engineers pay a number of visits to plants throughout the year. Similar arrangements have been made with public bodies and trade associations and this is, of course, the ideal way for the service to develop because it ensures the maintenance of high standards year in year out.

First-aid advice has been given, during the 11 months, to no fewer than 5,525 establishments.

Increased demand for Engineer time caused staffing shortage but recruitment is proceeding much more satisfactorily than was thought possible. A fuel engineer is not made simply by describing him as such; so internal courses have been devised to provide intensive training for the new recruits. In May, 1954, there were 126 engineers and 68 non technical staff. By 31st March, 1955, the number of engineers had increased 20 per cent without any increase in administrative staff.

Co-operation with other bodies, says the report, is essential if the task of overcoming the widespread apathy to fuel problems is to be realistically tackled. The whole time of 150 engineers, however well organized, is not really enough. Contacts have therefore been established in every quarter in which interest has been manifested. Consulting Engineers, Professional Institutes and Industrial Associations are regarded as natural allies in the campaign.

Need for Training within Industry

N.I.F.E.S. recognizes that lack of knowledge is a prime cause of fuel wastage and is co-operating with various bodies in supplying training courses.

N.I.F.E.S. have already organized one Refresher Course for Works Engineers at the Clarendon Laboratory, Oxford, and it was so successful that further courses are to be held. A recent and highly promising development is the arrangement of courses for management trainees covering the problems that factory managers are likely to encounter in the field of fuel utilization. To encourage boilerhouse operatives to come forward for training under the City and Guilds scheme, N.I.F.E.S. has awarded 12 prizes to the men most successful in this examination.

Government Loan Scheme

This has been made more attractive since it was first introduced by the Minister of Fuel and Power in June, 1952. The scheme now covers addition to existing plant or buildings that will result in substantial savings of fuel and applications for replacements come within the scheme if the plant is

not yet worn out. Loans are interest free for two years whilst repayment may be spread over a maximum period of 20 years.

N.I.F.E.S. acts only as technical advisers on the application for loans. During the period 1st May, 1954-31st March, 1955, 371 applications were dealt with and of these 139 were approved to a total of £815,314.

FUEL RESEARCH, 1954 is the title of the annual report of the Fuel Research Board, with the report of the Director of Fuel Research. (H.M.S.O. 3s.).

In their Report the Fuel Research Board record their satisfaction that the Fuel Research Station, with its knowledge and experience, was able to render service of the utmost value to the Committee on Air Pollution (Beaver Committee) but they note that to implement the recommendations of that committee will require a considerable extension of the work of the Station on many problems of reducing air pollution. Such an extension will have to be faced despite the difficulty of recruiting suitable staff. The Report shows how many of the problems of fuel economy that are being investigated are closely linked to the question of smoke abatement.

An example of this is the work on the production of free-burning coke for the domestic market. This is necessary because there are still something like 12 million old-fashioned open fire grates in use in this country, which are incapable of burning ordinary gasworks coke satisfactorily. Since a large proportion of domestic heating during the winter will have to continue to depend on solid fuel for many years to come, the production in much larger quantities than hitherto of smokeless solid fuel that will burn well in ordinary grates would make a substantial contribution to the reduction of domestic smoke. Work at the Station has now shown how such solid fuel can be produced in ordinary gasworks equipment by carbonizing weakly-caking coals, of which large reserves are available.

Judging from inquiries received by the boiler-making industry there is a demand for smoke-eliminating devices for forced-draught hand-fired boilers. Earlier work at the Station showed that the same principles of admission of air over the fire as were used for smoke elimination with natural-draught boilers can be successfully applied to forced-draught boilers and data were published from which a suitable smoke eliminator could be designed. No industrial firms, however, have taken advantage of this information to develop a commercial apparatus. It was decided therefore to carry out the necessary development work and a preliminary design suitable for a forced-draught Lancashire boiler was prepared. Equipment constructed to this design successfully eliminated smoke at all loads but it was found that certain alterations were required to improve the thermal efficiency at low loads. A modified smoke eliminator designed to obviate this defect is being constructed.

Domestic Heating

In the field of domestic heating the Calorimeter Building is yielding valuable quantitative information on the various ways in which the heat from solid fuel burnt in domestic grates and stoves is used or wasted. It is thus giving more accurate data than hitherto available on the factors affecting room-heating efficiencies with different types of heating. For example, with the simple open fire, it has been found that the efficiency with which useful heat is given to the room directly as radiation and indirectly by convection, increases as the rate of burning is reduced; the efficiency is also increased by the use of a chimney which cuts down the rate at which air is drawn up the chimney. With coal as the fuel, throat restrictors can also reduce the amount of smoke issuing from the chimney by as much as one third.

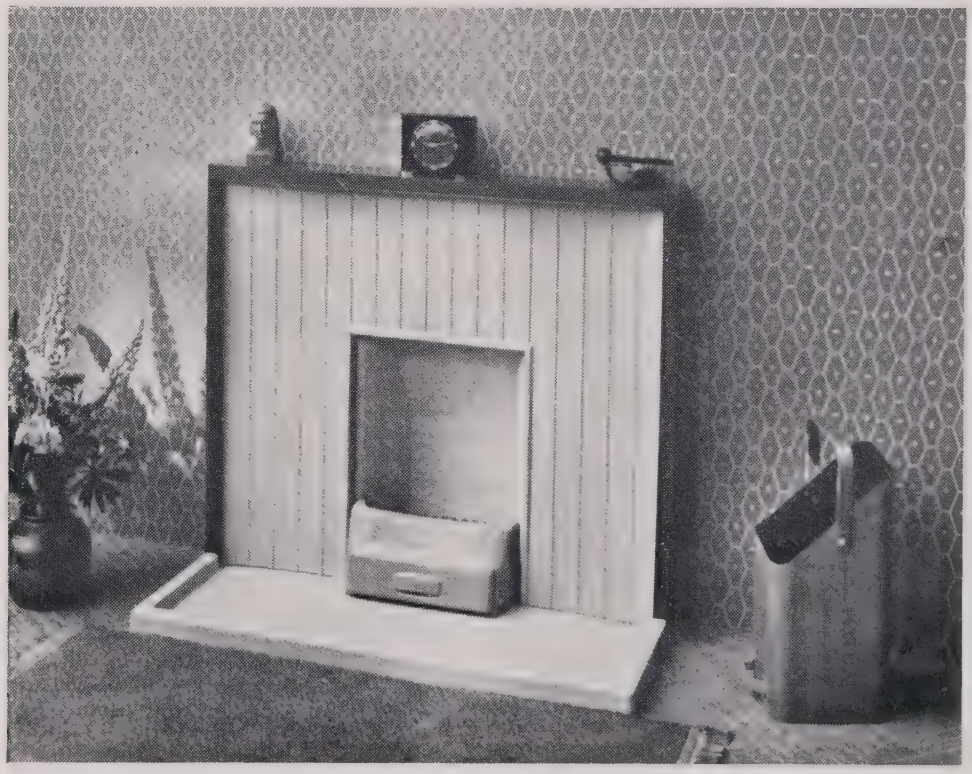
For the accurate measurement of the efficiency of stoves, the Calor-

imeter Building is indispensable. Work on the effects of leaks through badly-fitting doors of openable stoves has shown that such leaks cause appreciable reductions in efficiency, which may be as much as one quarter. It has also been found that one model of stove when closed burns coal with as high an efficiency as it burns coke, whereas usually with such stoves the efficiency with coal is lower than with coke. Investigations are being made to find the reasons for the differences in relative efficiencies with coal and coke for different stoves, with a view to defining the conditions leading to highest efficiencies and minimum smoke emission with coal.

Coal Firing for Gas Turbines

Work on problems of combustion that arise when solid fuels are used for providing the energy for gas turbines has been continued with the objects of developing combustion chambers for coal-fired gas turbines and of obtaining more fundamental knowledge on the combustion of solid fuels that may be applied to many other combustion or partial combustion (gasification) problems. During the year under review attention was concentrated on the problem of so arranging the detailed design for the Fuel Research Station straight-through combustion chamber that deposits of ash are not formed in it during operation. Considerable success has been achieved and a combustion chamber of this type is being built at the National Gas Turbine Establishment to work under pressure and to be tested when coupled to a gas turbine.

Details are also given in the Report of investigations at the Fuel Research Station on many other problems, for example, the gasification of low-grade fuels, the production of ash and chemicals by the Fischer-Tropsch synthesis, flow properties of residual fuel oils, the removal of sulphur compounds from flue gas and the chemistry of coal.



The setting of the new "approved" fires is a matter of importance, especially with modern furnishings. Here is the Contemporary Fireplace introduced by the Grange-Camelon Iron Co. Ltd., Falkirk. In the photograph it is fitted with a Sofono Lo-Front fire. The fireplace and hearth are of durable cast iron, vitreous enamelled in a choice of five colours. The polished wood surround is not included in the unit

NEWS

Included in news about smokeless zones in our last issue was a reference to Salford, which stated that the smokeless zone orders which were delayed on the original date of 1st January, came into operation on 1st May. This gives the wrong impression: the orders did come into force on 1st January, but because of conversion delays, etc., were not fully enforced until 1st May.

New ASME Guides

The Committee on Air Pollution Controls of the American Society of Mechanical Engineers has prepared and published two most useful guides. One is a list of the colleges, universities and research institutes—totalling 45 in all—in the U.S.A. engaged in air pollution research. Brief details are given of the studies in which each is engaged.

The second publication is a report, again in list form, of the instruments in use for the study of air pollution. The list is a lengthy one, and its scope may be indicated by the section headings: Smoke density, indicating and/or recording; Particulate matter, sampling in air or gaseous effluent; Particulate matter, measurement of in air or gaseous effluent; Gases, vapours, liquids, sampling and analysis of; Auxiliary devices for sampling air and gases; Particulate matter, counting of; Particulate matter, size distribution of; Particulate matter, chemical analysis of; Meteorological equipment; and finally, other equipment.

Inquiries about obtaining copies should be made to the Executive Secretary, ASME at 29 West 39th Street, New York, 18.

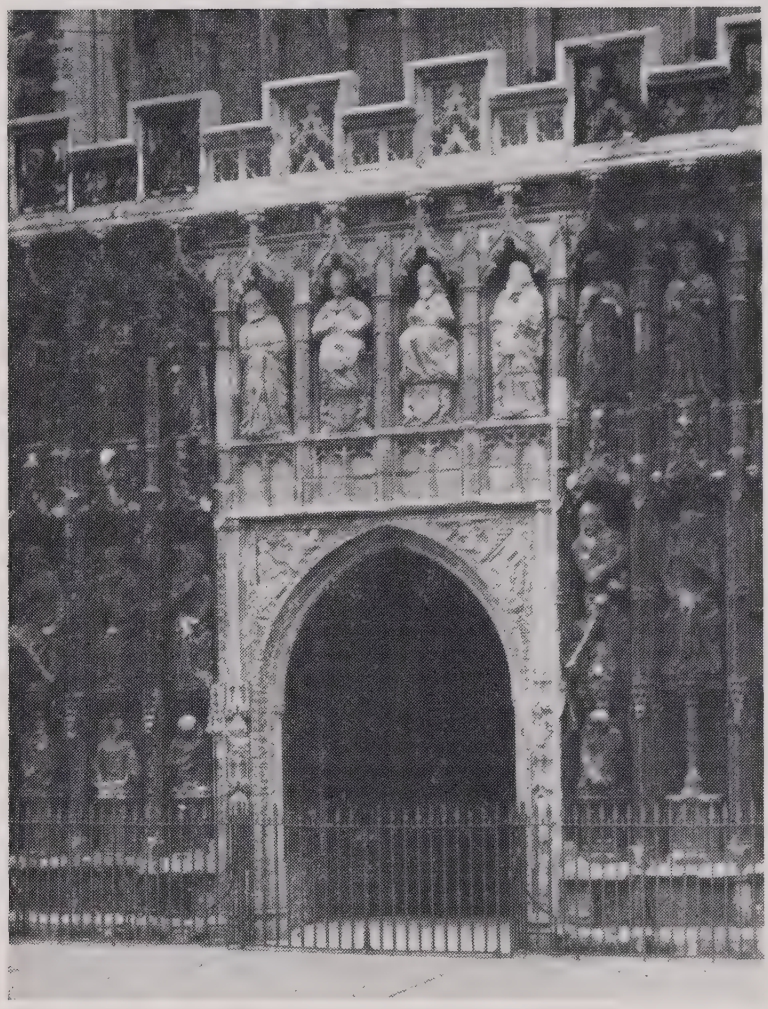
Protest Resolution on " Scheduled Processes "

At the Urban District Councils Diamond Jubilee Conference held in June, a resolution was carried protesting against that part of the Beaver Report which recommended that the " scheduled processes " should be wholly exempt from the general statutory provisions and from supervision by local authorities. It urged that the " scheduled processes " should be made subject to the general statutory provisions, except that the certificate of the alkali inspector that all available means had been taken to avoid an offence should be a good defence in any proceedings involving a scheduled process. The resolution also urged that every works carrying on a scheduled process should be subject to concurrent supervision both by the local authority and the alkali inspector; the local authorities to retain the duties of observation, enforcement, and local records and statistics, and the Alkali Inspectorate to be responsible for centralized research and experiment, certification, and advice to industry and local authorities in relation to air pollution by scheduled processes.

Electro-Precipitation

Simon-Carves Ltd. have published an informative illustrated brochure on " High Efficiency Electro-Precipitation," which contains much technical information and examples of the many uses to which their precipitators can be put. There is also a description of the chute-type receiving electrode (British Patent 716622). To precipitate the dust on the electrode is only half the problem of efficient dust removal by electro-precipitation: the other half is to get it into the collecting hopper without re-dispersal in the gas stream. The chute-type electrode is stated considerably to improve the collection efficiency. In one comparative test pocket electrodes gave an average dust removal efficiency of 94.9 per cent., while the tests on the chute electrodes gave an average efficiency of 97.9 per cent.—in other words, the dust outlet burden was reduced by more than half. A number of precipitators fitted with these electrodes are already in use or on order for CEA stations and for coal-dust removal for the N.C.B. South Western Division.

"This All-Devouring Smoak"



The 17th century phrase seems an appropriate comment on this, and the facing, photograph, which illustrate how the blackening and erosion of our ancient buildings goes steadily on, even far from the "black areas." On the left is the recently-cleaned front of Exeter Cathedral, which speaks plainly for itself. On the right is Tewkesbury Abbey, the cost of repairs to which will be £25,000 during the next five years. The archi-

Publicity Material

Members, particularly those representing local authorities, may like to know that, having a little more space at our disposal than before, part of one of the new rooms at Palace Chambers is being used for a permanent display of the exhibition material, posters and photographs that are available on loan. Inspection at any time is invited. In spare moments, between more pressing matters, we are trying to extend and improve the range of this material, aiming mostly at items that can easily be transported and stand up to hard wear.

Also of interest to those concerned with clean air lectures and talks will be a new list, prepared by the Society, of films relating to air pollution and its prevention or otherwise suitable for inclusion in such a programme. Copies may be obtained free on application.

Binding Cases for Smokeless Air

If a sufficient demand is apparent we shall be able to supply to readers a cloth-bound, loose-leaf binding cover, with the title of the journal on the spine, to hold 12 issues, which can be inserted as they are received, without perforation. The cost would not exceed 10s. each, post free. Will readers who would like to secure one of these cases please inform us by card, so that an order may be placed with the makers for an appropriate quantity? An order form, giving the price, will then be sent to those interested.

tect, Mr. A. B. Chatwin, recently said: "It is very sad to reflect that such mediaeval masonry, which has stood the assaults of weather for many centuries, has within living memory started to decay at an ever-increasing rate. There is reason to suppose that to a large extent this is attributable to pollution in the atmosphere, which even in country districts is now present in sufficient quantities to be harmful to the stone."



Photo: Evesham Herald

Commenting on the coal price increases recently announced, Sir Leslie Hollinghurst, Chairman of the National Fuel Efficiency Service, said that this was a challenge that industry could afford to accept. At first sight, an increase of 18 per cent on industry's fuel bill, now standing at £200-£250 millions for coal alone, might seem a serious threat to our power to compete in the export markets of the world. But NIFES found there were few works in general industry where fuel consumption could not be reduced by 15 to 20 per cent. The increased costs of fuel, therefore, could be offset by savings.

Sir Leslie said he had an urgent message for all industrial concerns, large and small. It was: "Make sure that your stokers and boiler operators take advantage of the facilities for training. See to it that every boiler fireman trains for the City and Guilds Certificate. This is the surest way to quick savings."

Parliamentary Question

Mr. P. Noel-Baker asked the Minister of Fuel and Power how many domestic solid-fuel appliances of the standard room efficiency of 40 per cent. recommended by the Ridley Commission have been supplied to householders in the United Kingdom since the Commission reported in 1952.

Mr. Geoffrey Lloyd: It is not yet possible to define standards based on room efficiency but up to May, 1955, about $3\frac{3}{4}$ million appliances of the highest minimum standard of efficiency considered practicable by my Ministry have been delivered to the home market.

Introducing a Smokeless Zone

A Woman's Viewpoint

This article was published in the May, 1955, issue of "Fuel Efficiency", from which it is reproduced by kind permission. Although it contains a few passages with which many will disagree (such as coke being just coal without its goodness!) we think it will be of interest to our readers, and particularly to those in local authorities who will be concerned with the establishment of smokeless or smoke-control areas. After hoping that the general election will not delay the introduction of a Clean Air Bill the author continues as follows.

IN any such legislation women's opinions figure largely for undoubtedly it is they who suffer most, in terms of unnecessary labour, as a result of a dirty atmosphere. In the home smoke means more work, clothes need washing more frequently and decorations become more expensive. Because of smoke, any artistic sense they may have in the use of pastel shades is stultified, for common sense prevails, limiting them to the traditional greens and browns "which don't show the dirt so easily."

The point I am making is that womenfolk will support clean air quite willingly and form an important means of harnessing public opinion in its favour. Nevertheless, they must, in general, be assured that any clean air measures will not add to their daily worries. Let me try to put their case as fairly as I can. There are some six million houses in Britain described by the experts as sub-standard—in simple fact this means that the amenities for providing hot water, cooking and heating are inadequate. These houses between them form more than one-third of the total number of houses in Britain. What is more, a very high proportion of them are most certainly situated in the "black" areas which are likely to be the first areas concerned with any clean air legislation. It is these houses which are mostly packed closely together and between them contribute mostly to the smoke nuisance. It is these houses which contain a high proportion of the old-fashioned open fires which will only work with bituminous coal. Already some eight million women are out at work out of a total working population of some 23 million—and many of these working women live in these houses. Also most of these houses are rented on a controlled rental basis which is a contributory factor in proving them attractive, in spite of their lack of amenities, to women with modest incomes who work them.

What is the Tenant's Incentive?

It is, therefore, against this background that one must review any social changes inherent in any clean air bill. When the industrialists of Manchester were first asked to cut down smoke from their chimneys they objected to the cost—in the end, when it was proved that smokelessness meant saving money they were convinced—but theirs was an almost immediate saving. The tenant in the houses such as I have described is not in such a fortunate position. The changeover from the old order to the new does mean some extra rent immediately in spite of assistance from the local authority or the central government and it is fair comment for any woman to ask the immediate benefits she will obtain from the immediate increase in cost. Believe me, exhortations to her to do this thing in the interests of the nation will be as fruitless as they were to the ears of the industrialist. Coerced charity from one part of the community was never well received. surely, then, the first thing that must be established in her mind is confidence. She can be offered a gas

water heater, an electric fire, a modern coke grate and a gas poker. Let us assume they cost her nothing—they will, of course, because the rent of her house will rise—but she will of course wish to know the running cost of these new appliances. It would be wrong to mislead, it is only fair to give her a true statement as to the expected cost and one has to face up to the fact that there will be an additional running cost due to the new amenities. One can argue that the extra cost is worth while and the extra money spent is serving a more useful purpose than that to which the woman may have put it—but the argument falls flat in a democracy which believes in freedom of choice, not only of its fuel but of the avenues in which it spends its income legally.

In the first case, therefore, we must face the unpleasant fact that in Britain the cheapest way of getting continuous heat is still by burning raw coal. As a nation we cannot afford to continue doing this but we cannot in fairness tax one part of the community because of geographical location preferentially against another. A sub-standard house in Devon may be immune—but one in Bolton affected, although both tenants directly benefit from the national economies of coal saving. The argument of reduced laundry bills in, say, Bolton is untrue for it is some time before the appreciable advantages of smoke abatement are felt. We all agree that clean air is an essential and it must be done but my main point is that if public confidence is to be maintained then it is essential that confidence is established with the householder involved; no untruths or half truths, no rosy pictures which will fade when exposed to the light of day, no false promises either in terms of performance of the new appliances or the new fuels and above all, no false estimates of the cost of running them.

Confidence in Campaign Essential

Undoubtedly, then, the prime essential is a house-to-house canvass by responsible officers of the local authority, first to gain this confidence and then to assess the extent of their problem in terms of appliances and fuels. To get as far as we have in terms of action towards the smoke nuisance has taken the country many many years and nothing could wreck the scheme more effectively than the enthusiast who envisages its abolition overnight. Slowly but relentlessly, building up public confidence with each step is the only foundation upon which success can be achieved. I am sorry if I seem to labour this point but I do sincerely believe that these factors are of vital importance.

Let us consider what is involved. First, the appliance replacement must be done quickly and as far as possible during those months when the necessity for a fire is at the minimum. Next, the modern grate must be operated with the kind of smokeless fuel the tenant is likely to get—it is useless to try out this test with selected fuel or indeed to assume that one modern grate is bound to be as good as the next. It is also equally wrong not to point out that with the smokeless fuel a different kind of fire, less easily lighted and more easily put out, is to be expected. Again the advantages of using the gas poker should be explained but likewise the cost disadvantage of its too frequent use. The need for attention to the air inlet and the need for more attention must be explained.

But perhaps of even greater importance is an assurance that the coke, which must play the most active part in smokeless fuel supply, is of consistently good quality. At present coke has a pretty poor valuation as a fuel in the householders' mind. First, it is as expensive as coal, it is more difficult to light and keep alight, it is often wet, its sizing is not always consistent whilst if it does contain a lot of breeze this product is of even less use than coal dust. Remember also that people have read of deaths from coke fires due to carbon monoxide poisoning—we know why, but that is another explanation which must be given to the housewife with infinite

patience. She will ask why coke, which is just coal without its goodness, is as expensive as coal. She will insist that a coke fire " smells ". She will say it needs more storage space. As a result the smoke abatement officers will need not only the knowledge to answer these questions but in addition the patience of Job!

Women the Spearhead

Above all, there must be no arbitrary treatment of the tenants by the officials in the early stages—women still remember the torment of queues for ration book renewals at the " Town Hall " and in general they are rightly or wrongly suspicious of " council officials ". With ration books they had no option but to " stand and wait " but if any attempt is made to apply high pressure tactics in the initial stages of instituting smoke abatement womenfolk will never make the new fuels or the new appliances work. Officials will be inundated with complaints and local members of parliament will be tormented to ask questions in the House on the " liberty of the subject ". In fact, in the appointment of smoke abatement officers tact, under the most exasperating circumstances will be an essential in the early stages. Of course when one area has been surveyed and dealt with satisfactorily so that the householder has expressed satisfaction the process of implementation of clean air can be speeded up step by step but until each local authority has at least one area dealt with in this manner, any attempt to press ahead can lead to considerable agitation and annoyance whilst simultaneously wrecking the cause of clean air.

I express these views as a woman for as I said at the outset, women more so than men want clean air and smokelessness. The tradition of the open fire is, I fear, mainly a man's tradition for he spends more time looking into the blaze. Mostly it is women who clean away its mess from the grate in the morning as well as its dust from everything in the room. It is upon her washing that the smuts in the atmosphere fall. She bears the brunt of a visit from the chimney sweep.

Women can be the spearhead of a crusade for clean air but only if they are dealt with fairly and squarely without any attempt to offer them promises which cannot be fulfilled. Whilst they can be an ally, it is so well known that they can become, quiet easily, a formidable enemy.

Longest Gas Grid

The final link in the first thousand miles of new main laid by the South Western Gas Board since nationalization was coupled up by Sir Harold Smith, Chairman of the Gas Council, at Beacon Hill, near Shepton Mallet, on Tuesday, 19th July, 1955.

The main will eventually be the longest gas grid in the country, from Evesham in Worcestershire, to Penzance in Cornwall, covering some 8,400 square miles.

The scheme when completed will result in the closing down of all the smaller and uneconomic works in the South West, leaving 16 major manufacturing stations to serve the area.

Since nationalization, 45 small works have been closed down and 15 more will be closed by March, 1956. During the same period a gas supply has been made available to 91 new centres of population and the main laying scheme will eventually take in a further 210 centres within the next two or three years.

Agecroft Generating Station Inquiry

A public inquiry into objections to the proposals of the Central Electricity Board for the Agecroft " B " Generating Station, at Swinton, Lancashire, has resulted in the approval by the Minister of Fuel and Power of the Authority's application. This is, however, subject to the requirement that the height of the chimney shall be 450 instead of 365 feet. The Minister is satisfied that the proposed equipment for the removal of dust and grit should be adequate.

Britain and the Nuclear Age

The place of Britain in the nuclear age and the part that British manufacture can play were dealt with by Sir Harry Railing (Chairman and Managing Director, General Electric Co. Ltd.), in his Presidential Address to the British Electrical Power Convention at Brighton on 28th June.

Sir Harry said that electrical consumption within twenty years would be more then trebled; it had already risen from 51.9 milliard units in 1950 to 69 milliard in 1954 and would soar to 225 milliard by 1975 if the present forecasts were valid.

To provide cheap energy, he said, the daily and seasonal peaks must be smoothed out. The most significant contribution towards this end could be made by storing electrical energy—a problem whose present limitations were well-known. Another solution was the pumped storage system. This method of power supply for peak loads and for supplementing the output of thermal stations would find a greatly extended application in the future. The next possible step lay in the application of off-peak storage for space heating, cooking and refrigeration and in the proper exploitation of the heat pump.

Sir Harry said he thought the anticipated demands for power could be met. By far the greater part for the next generation, would have to be supplied by coal—certainly as far as the United Kingdom was concerned. But coal alone could not meet the likely level of increased demand for energy. Even if the entire foreseeable increase in British coal production could be allocated to electrical power production, the nation would still be short, annually, of some 70 million tons: this deficit must be made good either by imported coal or by oil and by nuclear fuel. Those figures plainly illustrated the vital need to increase the output of coal during the next decade, to stop wastage of energy in whatever form, and to increase the efficiency of coal utilisation plants.

The ten years' programme for the construction of nuclear power stations, laid down by the Central Electricity Authority, provided for nuclear plant totalling 1,500/2,000 megawatts. By 1965 this would result in an aggregate annual saving of, say, six million tons of coal, thus releasing the energies of 18,000 workers in the coal fields. After 1965, a quarter of the capacity installed each year, say 500 megawatts might comprise nuclear power stations, so that a further $1\frac{1}{2}$ million tons might be replaced annually releasing a further 4,500 men per year. This could either make a substantial contribution towards the employment of men in industries other than mining, or release manpower for the production of coal for other than electrical power requirements.

If the nuclear power stations to be constructed during the next ten years prove to be not only satisfactory but capable of progressive development, there is no doubt that this type of station will form a large part of the annual power programme.

Although nuclear energy would begin to make a substantial contribution to the electricity generation programme, we should have to rely on an increase in the use of all forms of fuel to maintain an expanding economy. Unless we obtained it, we were bound to be short of power supply with all the dire consequences this entailed.

We must, therefore, concentrate on raising coal production, since we should still be relying on coal to the extent of 60 per cent to 75 per cent. for our energy consumption and 80 per cent. for our total fuel consumption. We must decide to what extent oil could economically replace or supplement coal for the next decade. We must further not only proceed with the construction of nuclear power stations, as outlined by the Govern-

ment, but also press on with advanced development, with the twofold object of ensuring a sufficiency of power for ourselves and maintaining a leading position in the construction of power plants in the world markets. The importance of continued leadership in this field for our country could not be over emphasized.

" A vast amount of development work will have to be undertaken in a comparatively short time if we are to maintain leadership," said Sir Harry. " Full inducement and encouragement must be given to those companies who are prepared to embark on this national task, which demands that they divert a large part of their human and material resources into channels which are bound to be unremunerative for a considerable time and in regard to which, in this country, we have to depend largely on a single authority for orders."

Combined Hot Water Service and Refrigerator



We illustrate the new " Duo Therm" heat pump, made by Brentford Electric Ltd., an appliance which installed in the larder keeps the whole of the space cool and fresh at 40°F. It contains a $2\frac{1}{2}$ cu. ft. refrigerator for additional cooling and ice-making, together with a thermostatically-controlled 30-gallon hot water tank, which provides up to 120 gallons a day at 140°F. An airing cupboard warmer can also be run off the appliance. The " Duo Therm " needs only to be connected up to the usual piping system and roof storage water tank. Plugging in to an ordinary three-pin lighting point completes the installation. Electrical consumption is 4 to 7 units a day, according to the water drawn off. The overall dimensions of the appliance are 2 feet square by just over 5 feet high.

Move to Deal with Smoke Complaints

Workers at Elkington and Co. Ltd., Walsall, have taken steps on their own initiative to investigate and lessen complaints about smoke nuisances from the factory by nearby residents. They have elected a four-man committee, all of whom live near the factory, to investigate complaints by residents on the spot and to make recommendation to the management. As all the members work at different times during the day, this enables one representative to be available to members of the public while at his own home.

A trade union in Glasgow has asked the Corporation to consider a proposal that boiler firemen in their employment should receive special wage increases for efficiency. At present a lump payment of £5 is made when they obtain efficiency certificates as a result of examinations held under the auspices of the Scottish Division of the Society. It is urged that these should be discontinued and a weekly wage increase granted.

SMOKE PREVENTION ABSTRACTS

221. Production of Carbonized Agglomerates such as Carbonized Agglomerated Fuel and Means Therefor. C.U.R.A. Patents Ltd., G. W. C. Allan and G. A. Sparham. (Brit. Pat. 719 999. Appl. date 1st Dec., 1952). A combined pelleting and carbonizing process is described. Fine coal, which becomes sticky at certain elevated temperatures, is fed to an inclined tray and heated. When the coal is in the sticky condition, the tray is subjected to an oscillatory motion with a horizontal component and agglomerates are formed which pass through several parallel channels in the tray whilst undergoing carbonization. The axes of the channels are normal to the direction of movement of the agglomerated particles. (B.C.U.R.A.).

222. The Removal of Sulphur from Coke during Carbonization. T. Kato and K. Takeshita. (J. Fuel Soc. Japan, 1954, **33**, (Oct.), 531-6. In Japanese. Summary in English). Various inorganic compounds were added to the coal charges, and the S contents of the cokes produced were determined. From crucible tests and semi-industrial coking tests with a horizontal retort, it was deduced that: (1) the addition of NH4CE results in only a slight decrease in the S content of the coke and in hardly any change in its strength or reactivity; and (2) the addition of a mixture of sodium cyanide and carbonate results in the removal of most of the S—both organic and inorganic—from the coke, and in a slight decrease in its strength and increase in its reactivity, but the sodium cyanide exerts a corrosive action on the refractories of the oven. (Authors' Abstract in English and B.C.U.R.A.).

223. Air Pollution Control on the Canadian National Railways. Patterson, C. R. (Air Repair, Feb., 1955, **4**, 188, 218). System of supervision and enforcement of smoke abatement regulations, methods of steaming and fire building, use of sealed brick arches and overfire jets, draughting and maintenance of locomotives, etc., are described. (D.S.I.R.).

224. New Multiswirl Hydrostatic Dust Collector. (Pwr. & Wks. Engng., Dec., 1954, **49**, 441, 442). Dallow Lambert and Co., Leicester, are producing a new type of collector, embodying a patent hydrostatic cross tube element to scrub dust-laden air in either water or oil. The element is partly submerged and has the dust-laden air passed across it. A double separation takes place, by impingement on the surface of the liquid and by scrubbing action on the wet elements, removing the heavier dust. The air then turns through 90° and passes along the branch ducts of the cross tube elements, wetting the walls of each duct. These wet surfaces, plus the spray formed, entrain the fine dust. The air is then passed through a liquid curtain and finally through eliminator baffles. Very high separation efficiency is claimed in a very compact form. The range extends from 200 to 100,000 cu. ft./min. (D.S.I.R.).

225. Use of Power Station Waste Products. Muir, G. D. (Research, Lond., Mar., 1955, **8**, 82-87). After reference to air pollution by sulphur dioxide by power station flue gases and to the Fulham-Simon-Carves process, by which this sulphur may be recovered as ammonium sulphate, an account is given of how the washed flue gases may be put to further use, i.e. for carbon dioxide " manuring " of greenhouse crops and for algal culture. The latter process is being investigated in a battery of six 500 gallon tanks at Poole Generating Station of the B.E.A. (D.S.I.R.).

226. Aromatic Hydrocarbons. III. Presence in the Particulate Phase of Diesel Engine Exhausts and the Carcinogenecity of Exhaust Extracts. Kotin, P., Falk, H. L. and Thomas, M. (A.M.A. Arch. industr. Hlth., Feb., 1955, vol. II, 113-120). The particulate phase of diesel engine exhaust products was analysed. Carcinogenic hydrocarbons were demonstrated among these products. Their production under varying conditions of engine operation was determined. Extracts of the particulate phase of the exhaust products were successfully used in painting experiments to produce skin papillomas in C57 black mice and cancers in A strain mice. The yield of aromatic polycyclic hydrocarbons, including benzpyrene, from the exhaust of an inefficiently operating diesel engine was high. The increase in these emissions as the load and engine speed are increased is in marked contrast to a gasoline engine where load and speed increase reduce the amount of aromatic polycyclic hydrocarbons emitted into the air. D.S.I.R.).

227. Muffler Needs Further Development. (APF Release. Smog News, No. 42, May 30th, 1955). Three months of rigorous road testing of the Houdry catalytic converter have convinced scientists of the A-P Foundation that the muffler is not yet ready to be recommended as a potential smog eliminator for public adoption. In announcing the completion of exhaustive tests of the device on the proving grounds of Southwest Research Institute at San Antonio, Texas, the Foundation reported that the converter proved capable of removing more than 80 per cent of an auto's hydrocarbon emissions when first attached, but that it appears to wear out too soon to warrant Foundation endorsement. (See note and illustration in Summer 1955 *Smokeless Air*).

Abstracts of a selection of 26 papers Read at the First International Congress on Air Pollution, American Society of Mechanical Engineers, New York City, 1st and 2nd March 1955.

228. Exhaust Gases from Diesel Engines. R. F. Davis and J. C. Holtz. (Diesel Test and Research Section, Bureau of Mines, U.S. Department of the Interior, Pittsburgh, Pa.). Experiments have been carried out on two diesel engines with a view to testing the effectiveness of exhaust gas scrubbing for reducing smoke and odour emission. Various scrubbing solutions were tried including water and aqueous solutions of sodium sulphite, ferrous sulphate, hydroquinone, cupric acetate, and chromic acid. From these experiments, it appears that the main cause of odour and of eye irritation due to diesel exhaust gases is the aldehyde content of the gases. Experiments with fuels of varying sulphur content showed that all the sulphur appeared in the exhaust gases as sulphur dioxide or sulphur trioxide. The effect of varying air/fuel ratios, at different altitudes, on the formation of smoke and on the odour content of the exhaust gas has also been studied; this work is continuing.

229. Air Pollution Control: Associated Health Implications. E. A Watkinson. (Chief, Occupational Health Division, Dept. of National Health and Welfare, Ottawa, Ontario, Canada). A distinction should be drawn between, on the one hand, the air pollution incidents in Donora, Meuse Valley, and Poza Rica, and, on the other, the London incident of December 1952. The latter incident was relatively featureless with respect to unusual constituents or concentrations, whereas the other incidents were characterized by high concentrations of specific pollutants—hydrogen sulphide in Poza Rica, and metallic salts and irritant gases in Donora and Meuse Valley. Although substantial

amounts of sulphur dioxide and soot were present in the London incident, the concentrations found do not seem to account for the effects observed. It is necessary to postulate that synergistic, absorption or solubility effects were operative; these postulates require much further investigation.

Fairly well defined damage to the human body can be associated with the acute effects following exposure to high concentrations of many toxicants, but this evidence is of little value in determining the effects of long exposure to lower concentrations. More definitive correlations would be obtained from properly designed surveys of the type now being made in the Detroit (Michigan)—Windsor (Ontario) area. Here, sickness records are being kept of members of households in districts subject to different average pollution levels. The basic purpose of this study, which is part of a comprehensive survey of all aspects of air pollution in Detroit—Windsor, is to determine the effects on health of long exposure to common pollutants in a heavily industrialized area. Observations made in adjacent communities outside the metropolitan area, will serve as controls.

230. The Removal of Sulphur Dioxide from Power Plant Stack Gases. R. L. Rees. (Chief Chemist, B.E.A., Bankside House, London, England). The only power stations in the world in which flue gases are washed are in London, where the " Battersea " process is in use at the oil-burning Bankside and the coal-burning Battersea stations. In this process the flue gases are washed with river water to which small amounts of chalk and manganese sulphate are added; approximately 95 per cent of the sulphur dioxide in the gases is removed, the product being largely calcium sulphate which is then discharged, in solution, into the river. The principal defects of this process are the high maintenance costs, the extent to which it cools the gases (see below), and the fact that it can be used only on a major river or estuary. A process in which the flue gases were washed continuously with a circulating alkaline solution (chalk or lime) was in use at Fulham Power Station, London, for a few years up to 1940. This process, which was generally troublesome and costly, gave rise to a sludge of calcium sulphate which had to be transported, then dumped. A promising development of this Fulham " cyclic lime " process is the ammoniacal liquor process described in Paper 16; the latter process is expected to be cheaper than other known gas-washing processes. The ammoniacal liquor process gives rise to saleable by-products but its application is likely to be controlled by the limited availability of cheap gas works liquor.

All recently built power stations in Great Britain have stacks at least 300 feet high. Continuous surveys of the mean monthly sulphation rates in the vicinities of such stations, have shown that after their coming into use, there is no appreciable increase in ground level concentrations of sulphur dioxide; it is therefore concluded that tall chimneys are effective in dispersing hot unwashed flue gases into the upper atmosphere. This is in contradistinction to gas-washing processes which cool the flue gases to about 100°F., so that under certain weather conditions the gases descend to ground level.

231. Experience with Air Pollution in Holland. A. J. Ter Linden. (Technische Hogeschool Laboratorium voor Warmte en Stofttechniek, Delft, The Netherlands). Pollution of the air by dust particles and gases leaving the stacks of industrial plants has become serious in several districts of Holland. For example, malodorous gases from an oil refinery near Rotterdam can be detected ten to fifteen miles away at Delft and The Hague, and elsewhere damage has been caused to the cultivation of bulbs by the sulphur containing gases from a large blast furnace. Instructions to keep such nuisances within reasonable bounds are necessary. These instructions should not be based

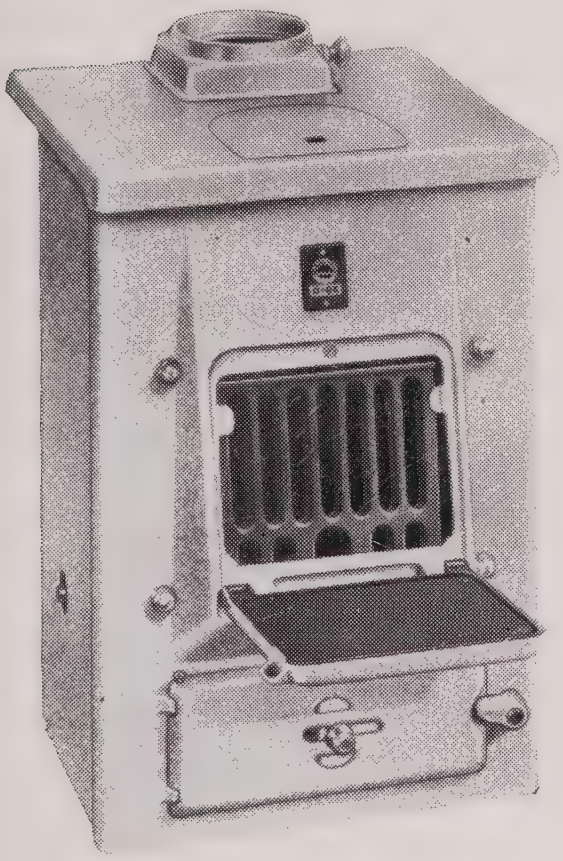
only on the quantity of dust or gases leaving the stacks but should also take into account the height of the stacks and the sizes of the dust particles. The deposit of dust in the neighbourhood of a boiler house has been calculated approximately and a mathematical formula for this deposit has been derived. Making use of this formula, a code of practice for new boilers of medium capacity has been issued in Holland by a committee of specialists. Although this code of practice was required by law, people have conformed well to it.

232. Abiotic Disease in Forest Stands Caused by Sulphurous Gases. N. F. Dos Santos De Azevedo. (Forest Services, The National Agronomic Station, Lisbon, Portugal). Two cases are described of damage to forest stands of maritime pine and eucalyptus, both occurring in the district of Aveiro, Portugal, and both caused by atmospheric pollution resulting from industrial plants. The first case is that of a mixed stand of pine and eucalyptus near a pyrites smelter. In the early stage, brown patches appeared on the leaves. In the more advanced stages of the attack, silver patches developed which ultimately turned into corroded areas: finally, the leaves fell and the trees were left completely bare. The second case is that of two pine stands in the vicinity of a brickyard where the exhaust gases from an oil engine caused severe damage to the trees. A great many of the pine needles were dry and appeared burnt. Secondary branches, the upper parts of the trunks, and the twigs were found to be soft. The damage in these stands was considerable, a great number of trees having been killed. From observations *in loco* and from microscopic and chemical analyses, it is almost certain that damage in both these cases was due to atmospheric pollution by sulphur-containing gases.

233. Sulphur in Iron and Steel Making. Colclough, T. P. (Technical Adviser, British Iron and Steel Federation, Steel House, London, England). As is well known, the presence of sulphur in iron or steel, except in certain special conditions, is harmful, and rigid limits on the amount permissible are imposed by standard specifications. For ordinary commercial steels, the maximum sulphur content is specified as 0.06 per cent, for steels subject to deep-drawing operations 0.025 per cent, and for certain special qualities, even lower limits are imposed. In the manufacture of the coke used in iron or steel making, some 60 per cent of the sulphur in the raw coal is retained in the coke. The remainder is found in the tar and coke-oven gas. In the smelting of pig iron, the whole of the sulphur present in the coke, ore, and other raw materials used, is absorbed in the blast-furnace slag with the exception of a small amount in the iron itself. No sulphur bearing gases are formed. In steel making, the sulphur removed from the metal is retained in the furnace slag. Chimney gases from the furnaces carry away all the sulphur dioxide formed by the combustion of the sulphur in the fuel used. The same conditions apply to the rolling and forging heating operations. In general, the iron and steel industry presents no unique or specific problem as far as atmospheric pollution by sulphur compounds is concerned. In fact, the emission of sulphur, with respect to the amount of sulphur entering the system is far less than in many other industries or in domestic fires.

234. Recovery and Utilization of Sulphur from Coke Oven Gas. Kurtz, J. K. (Bethlehem Steel Co., Sparrows Point, Maryland). 12,700 tons of coal per day are converted to coke at the Sparrows Point Plant of Bethlehem Steel Co. The coking operation gives rise to 140,000,000 cubic feet per day of coke-oven gas, all of which is used within the plant, and to large tonnages of tar, ammonia, pyridines, naphthalene and light oils. About half of the gas produced is used in open-hearth furnaces, but for this purpose, it must

first be treated for removal of its hydrogen sulphide content (400 grains per 100 cubic feet). The desulphurizing plant consists of three units in parallel, each of which operates on an absorption-desorption cycle, the absorbant being sodium carbonate solution. The " foul " coke-oven gas at a pressure of 20 p.s.i. flows upwards through a tower through which the absorbing solution is circulated; the maximum gas flow through each tower is 1,300,000 cubic feet per hour. Hydrogen sulphide, hydrogen cyanide, and carbon dioxide are absorbed by the carbonate solution and the resulting solution is run off into an " actifier ". Here, the gases are stripped from solution by steam and the reactivated carbonate solution is recycled. The liberated gas is washed with oil to remove naphthalene, and then with water to remove hydrogen cyanide. The remaining gas, now rich in hydrogen sulphide, is fed to a contact sulphuric acid plant which can produce 250 tons per day of 100 per cent acid. The acid so produced is used within the plant for the various pickling operations, for converting the coke-oven ammonia to ammonium sulphate and for refining the light oil. The overall removal and utilization efficiency of hydrogen sulphide is 90 per cent.



The well-known Ideal O-DC boiler is to be replaced by this new O-DE model. To be sold at the same low price, it is both more efficient and of improved appearance. Details will be found in the advertisement on page 9

Coalite

At the 38th Annual General Meeting of Coalite and Chemical Products Ltd., in London on 7th July, the Chairman, Commander Colin Buist, M.V.O., R.N. (ret.), made reference to the important developments now in progress in the abatement of smoke. " It seems," he said, " that the campaign for cleaner skies in which this Company has taken a leading part for more than forty years, is nearing a successful conclusion. Victory is in sight and we must take advantage of it."

Commander Buist, speaking of plans for expansion, said that three new batteries at Bolsover should be in production by the turn of this year, and it was now planned to build a further three on the same site. Substantial additions and modifications to the ancillary plant were required in consequence. By the end of 1956 the Bolsover plant would be nearly three times its original capacity, and the two Coalite works together would be carbonizing 720,000 tons of coal a year.

The accounts show that after allowing for £263,886 taxation the net profits of the Group total £238,650, compared with £183,267 last year.

Some Recent Meetings

A number of interesting papers have been presented at recent meetings and conferences.

Among these is a paper on the " Prevention of Smoke from Heating Boilers," by T. F. Hurley and L. J. Flaws, given at a sessional meeting of the Institution of Heating and Ventilating Engineers on December 1st 1954. In this paper some of the problems associated with the production of smoke and its prevention are discussed, making use of the results of experimental work carried out at the Fuel Research Station on different types of boiler commonly used by heating engineers, viz., a hand-fired Lancashire boiler, a hand-fired vertical boiler, and two sectional heating boilers fired mechanically with coal and oil, respectively. It is shown that the amount of smoke produced is influenced by the design of the combustion chamber and firing equipment, by the type of fuel, and by the method of operation.

A paper read at the recent conference of the Institute of Public Cleansing was on " The Control, Recovery and Disposal of Dust and Fumes in Refuse-Disposal Works," by E. J. Taylor, M.I.E.E., of the Birmingham Salvage Department. The author dealt mainly with the control of dust and fumes within the works, but included a section on " Dust control for external conditions."

A two-day symposium was organized recently in London by the Society of Chemical Industry. The first day was concerned with water pollution, and the second to papers and discussion on air pollution. Among the papers was one by W. A. Damon, Chief Inspector of Alkali &c, Works, on " Abatement of Air Pollution in the Chemical Industry," and one by E. Burke on " Dust Arrestment in the Cement Industry."

At the annual regional conference of the National Housing and Town Planning Council, held at Wandsworth on 7th June, a paper was read on " Economic Heating of Council Dwellings in Relation to Smoke Abatement." The joint authors were Philip V. Marchant and W. H. Beesley, both of the Borough Engineers' Department of the Wandsworth Borough Council.

The annual conference of the Townswomen's Guild at Edinburgh in June, attended by 3,000 members, heard a brains trust on smoke prevention. There were many questions on practical subjects—the cost and availability of smokeless fuels, railway smoke, and even the effects of atomic energy. The trust included Mr. John Innes, President of the Scottish Division of the Society, and representatives of the solid fuel, gas and electricity interests. In the Chair was Mr. A. Ludgater, Manager of the Solid Smokeless Fuels Federation.

B.M.A. and Diesel Fumes

The annual representative meeting of the British Medical Association, meeting in London on 2nd June, carried a resolution drawing the attention of the transport authorities to the possibility that fumes from diesel engines might be a cause of the increase in lung cancer and viewing with alarm the forthcoming replacement in London of 1,800 electric trolley-buses by diesel engined vehicles. Moving the resolution Dr. J. O. M. Rees (Guildford) said that " The diesel era started about 1934 and I am informed there is a time lag of 15 to 20 years in the growth of cancer of the lung. It may be a coincidence, but it is too sinister to let it go at that."

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As in any other periodical the advertisements in "Smokeless Air" are there for business, but they do help the journal, and thus the Society, in their campaign for cleaner air. In return we ask readers to support our advertisers and to mention "Smokeless Air" when communicating with them.

A higher proportion of British immigrants die of lung cancer in New Zealand than native born inhabitants, the Health Department has announced. The department blames coal, not tobacco, smoke for this.

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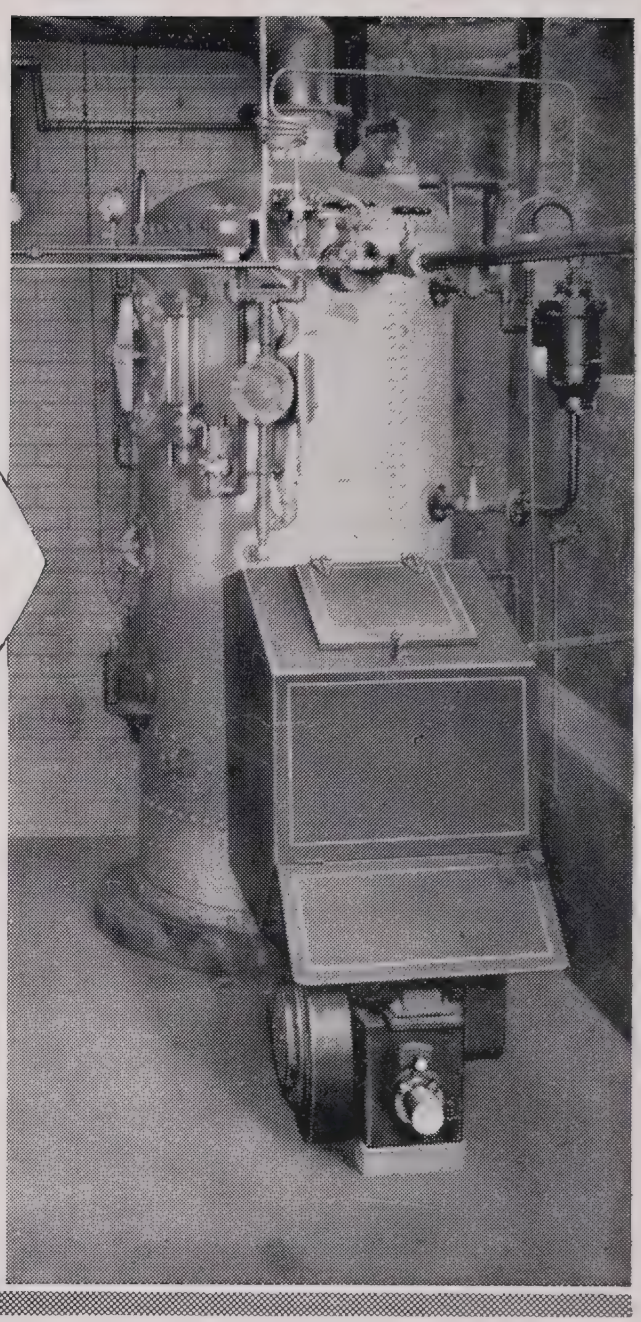
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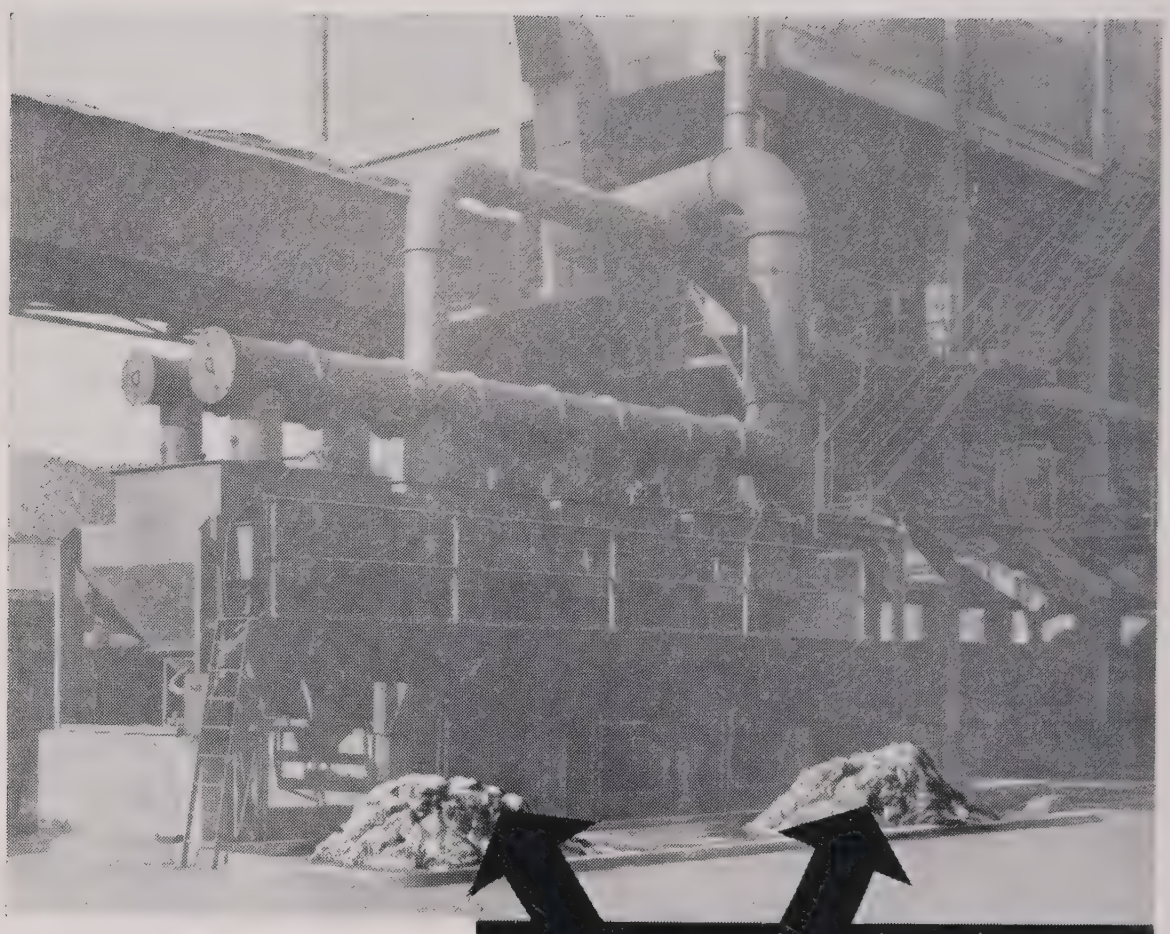
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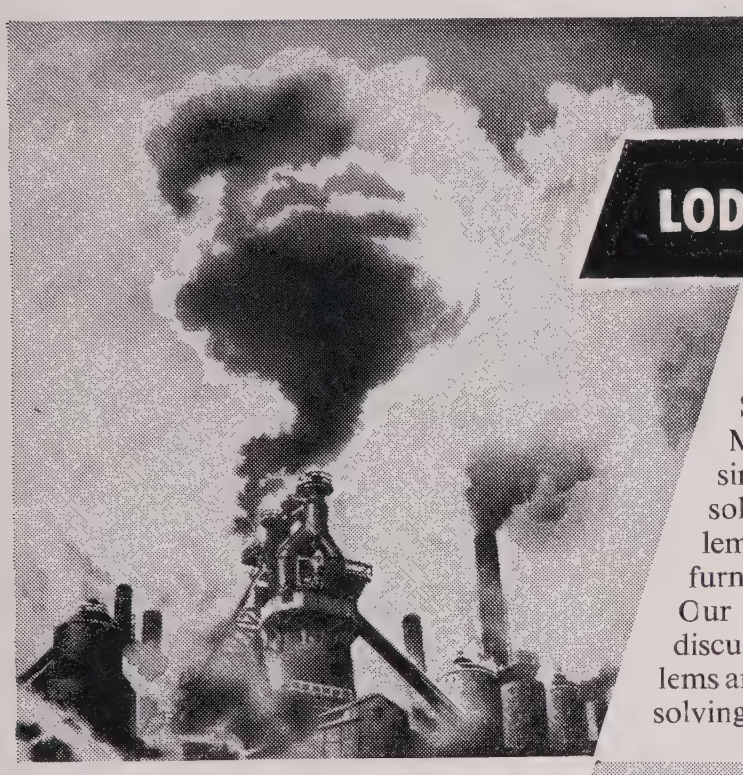
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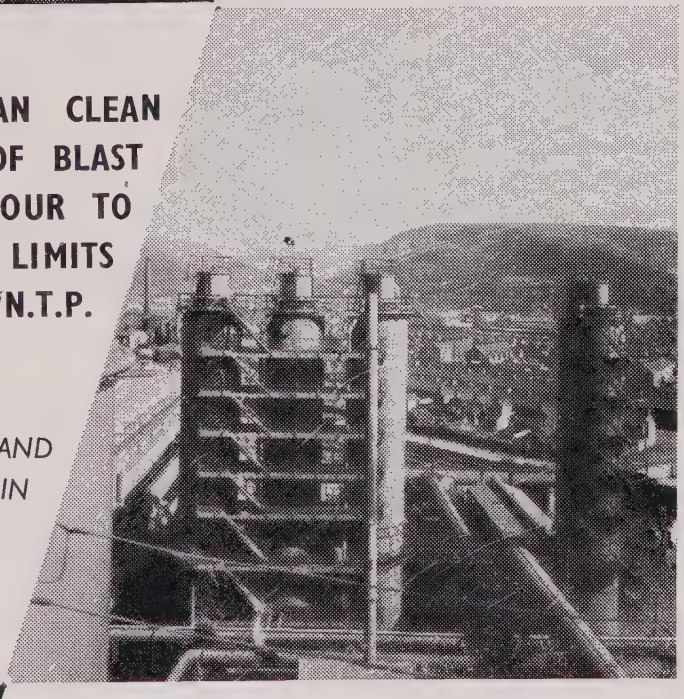
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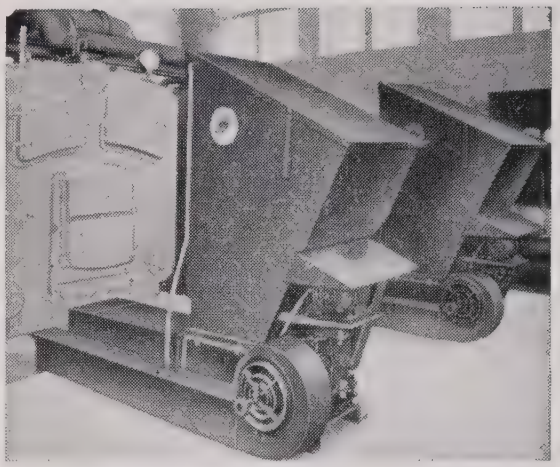
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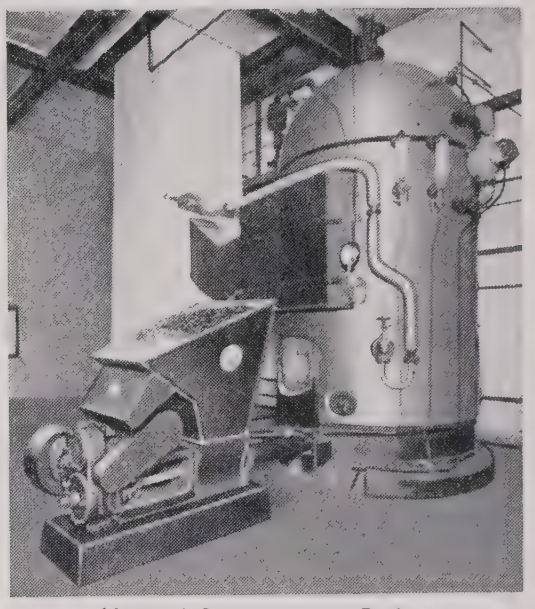
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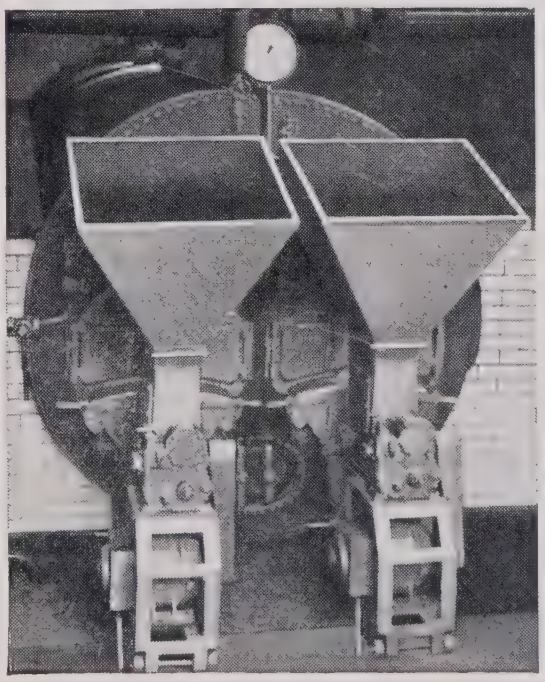
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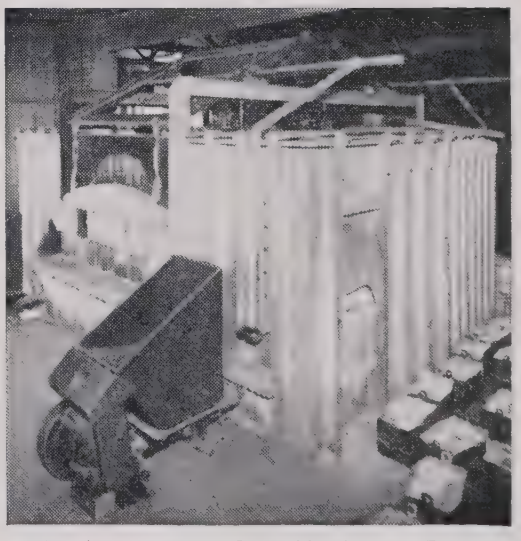
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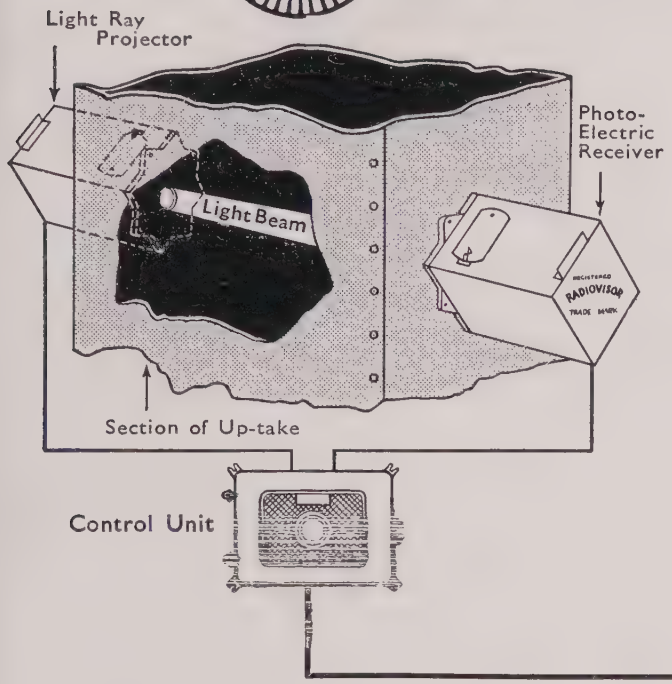
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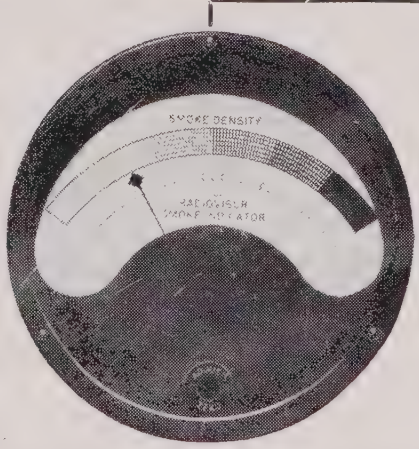
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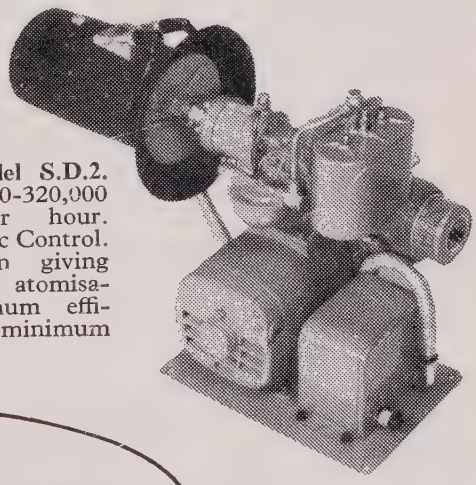
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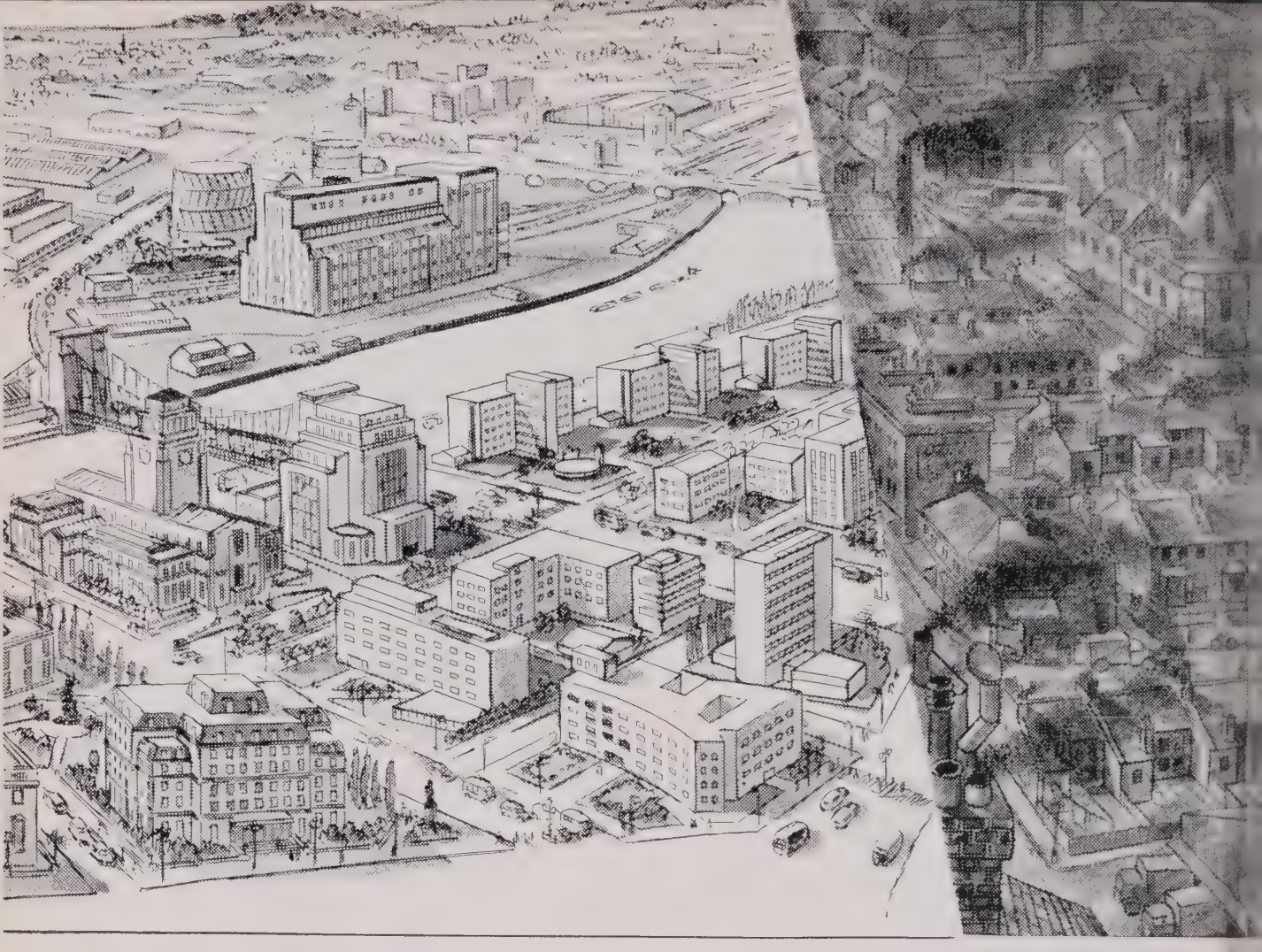
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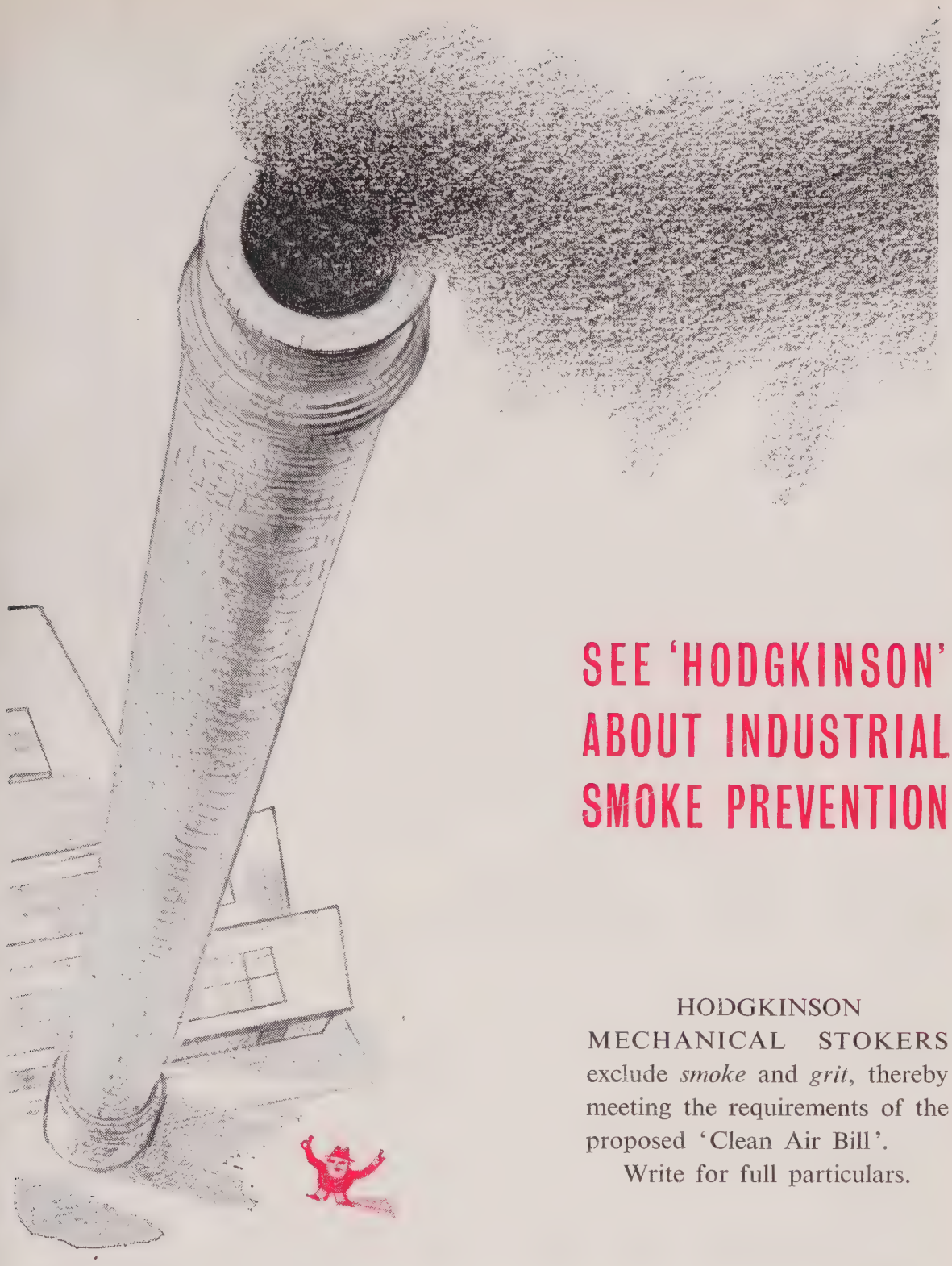
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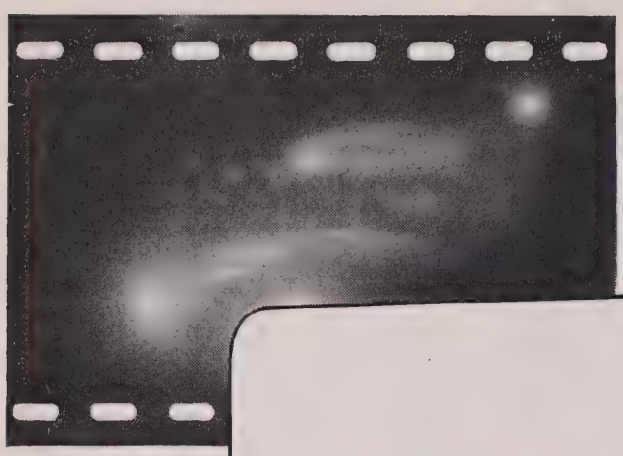
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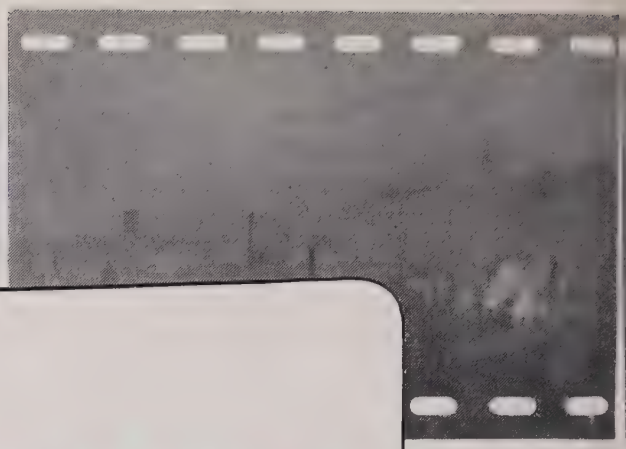
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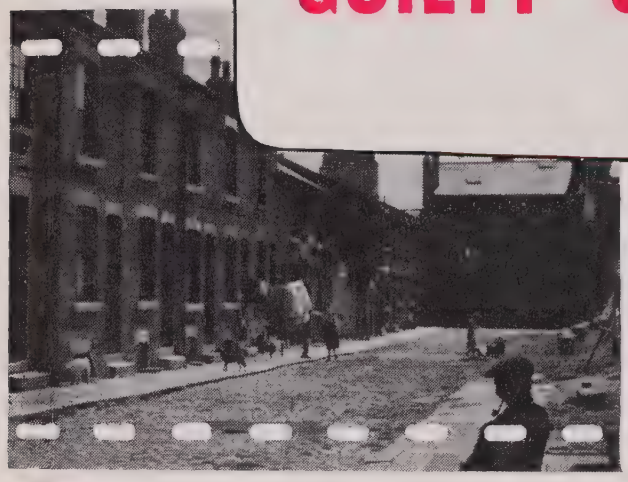
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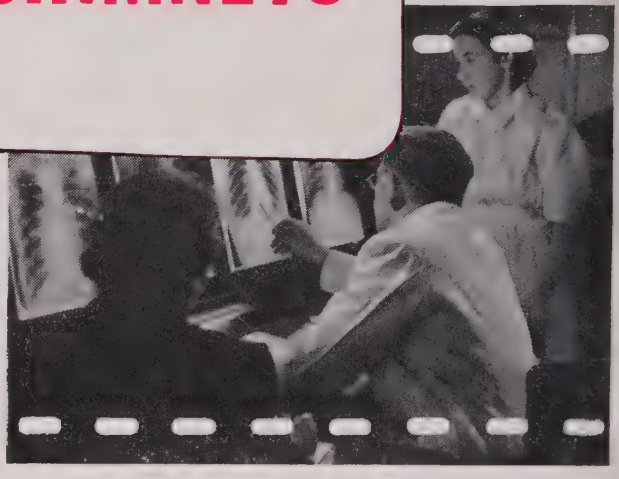
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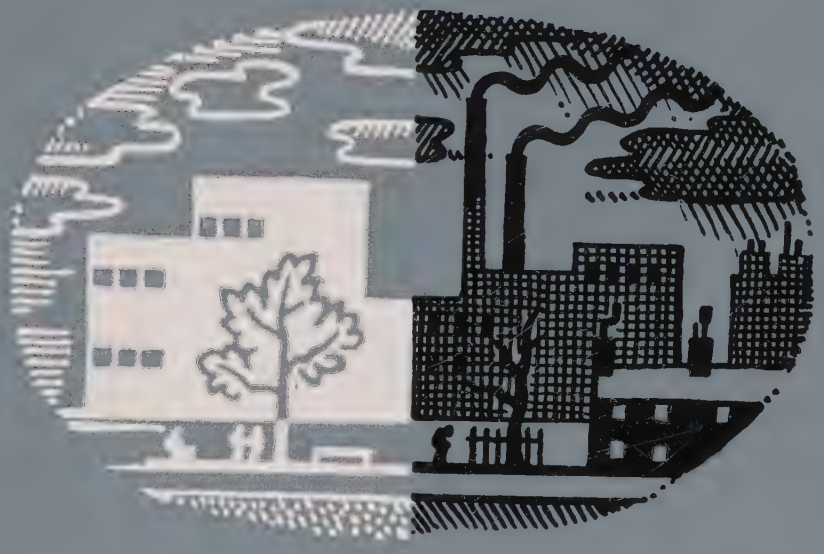
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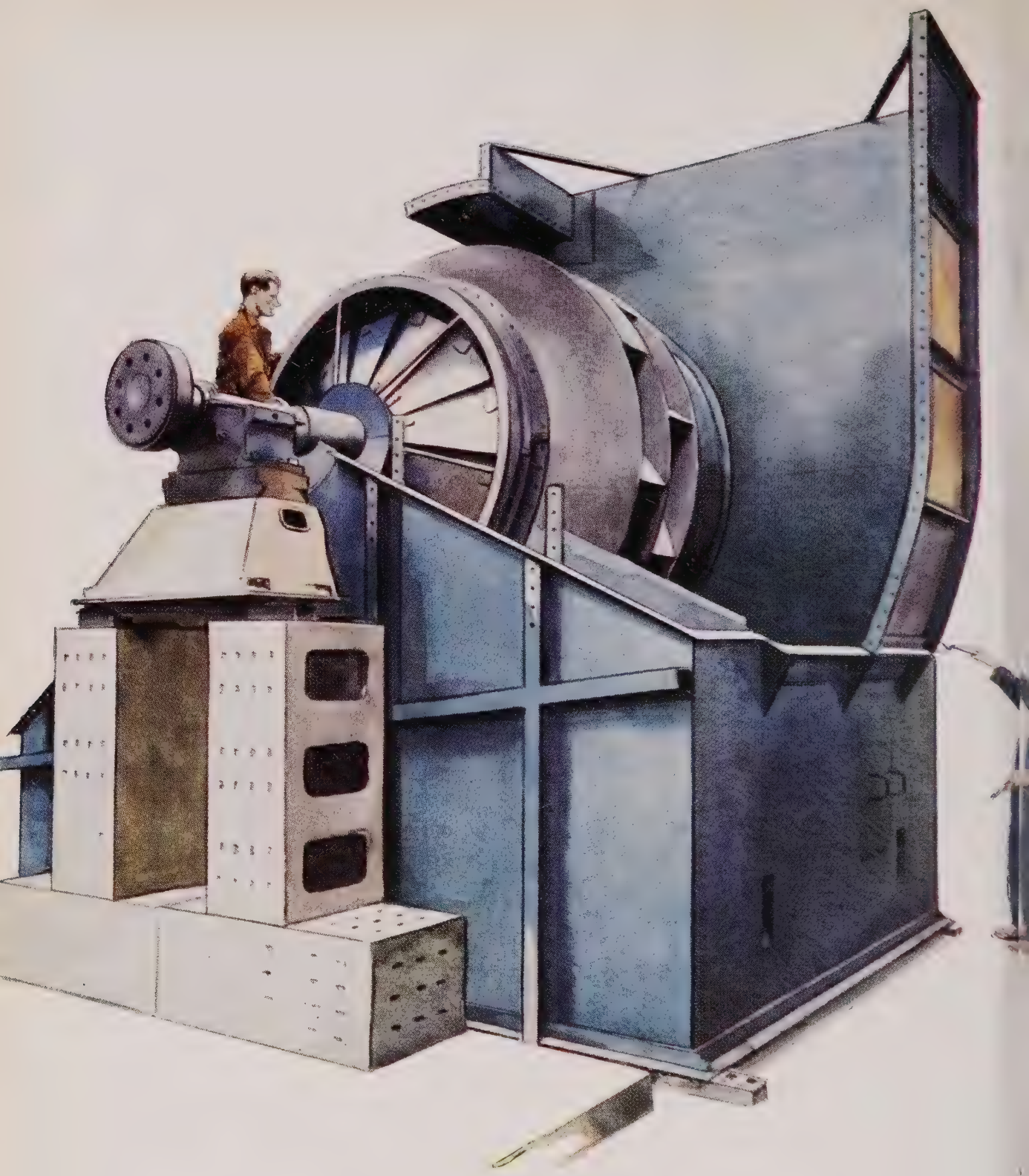


No. 96 WINTER 1955

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Second Reading of the Clean Air Bill
The Bournemouth Conference
Chimneys and the Dispersal of Smoke
A.P. and Lung Cancer
The Society's Need to Develop



Assembling a Howden induced-draught fan with vane control

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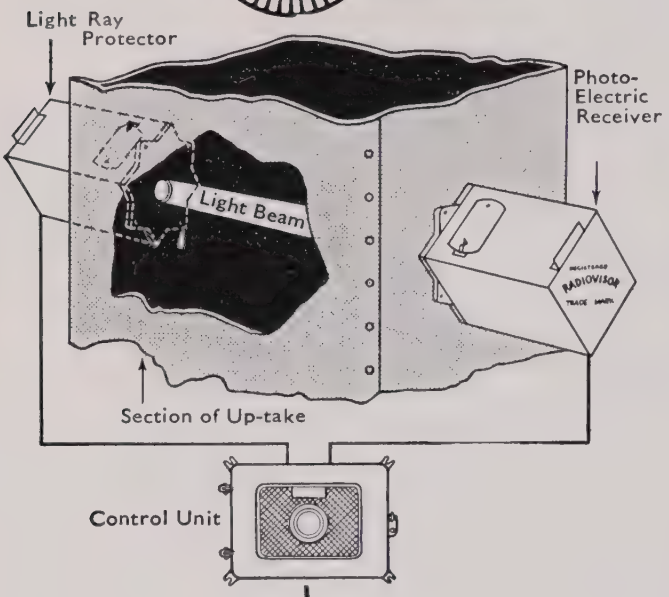
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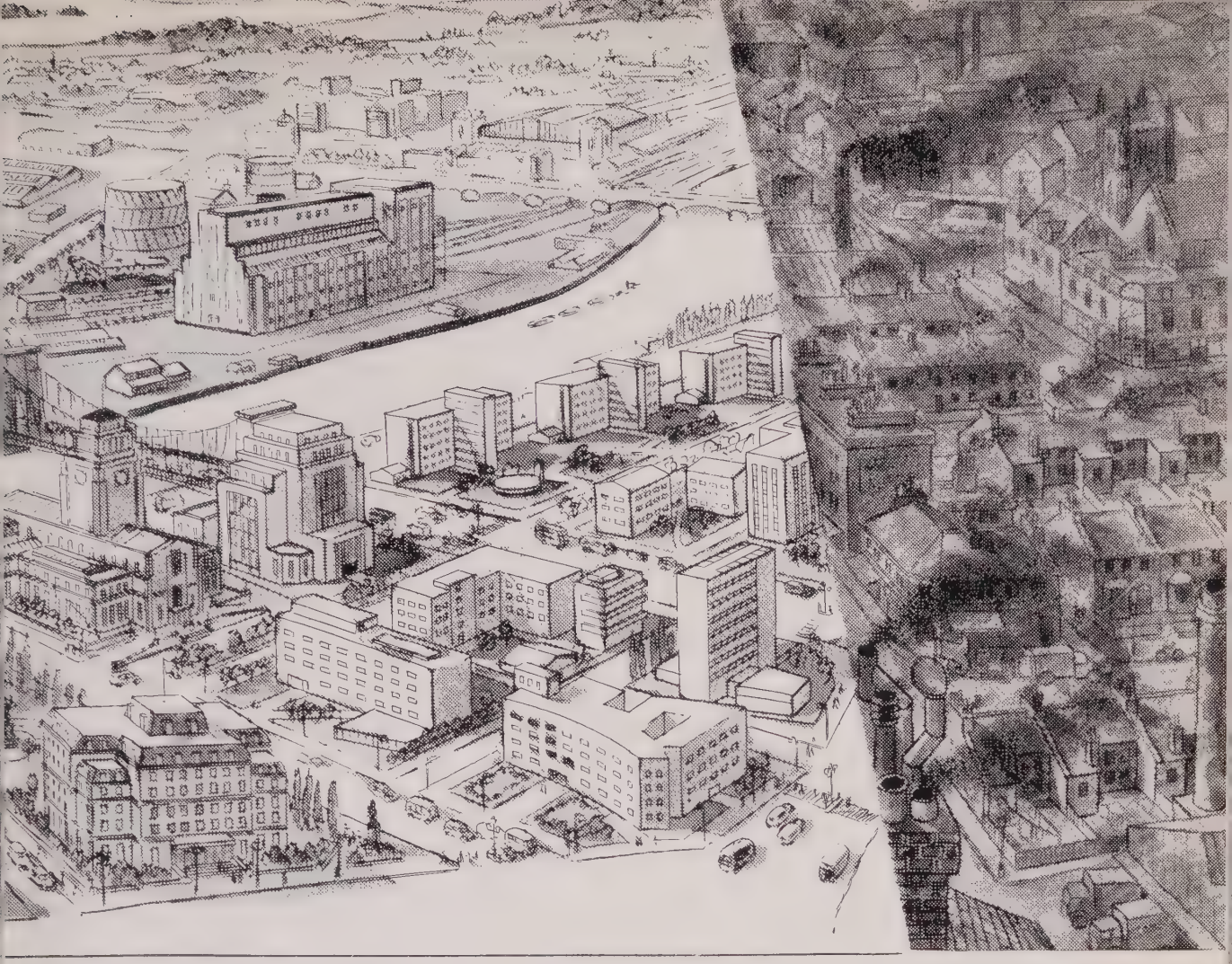
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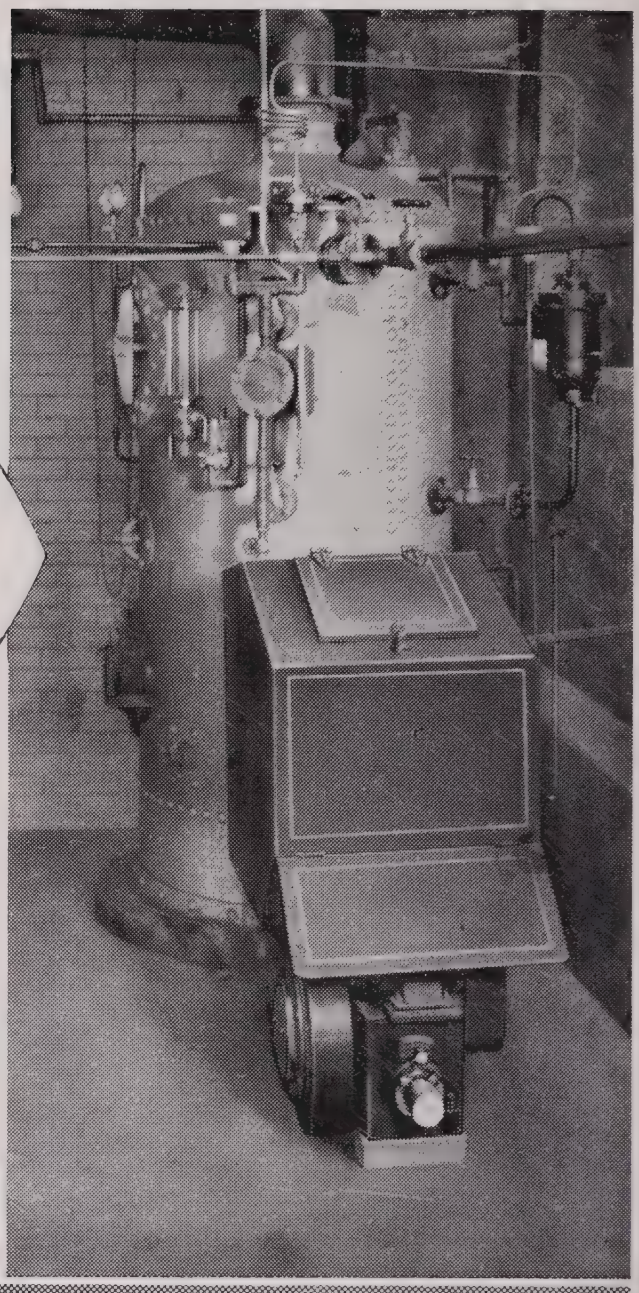
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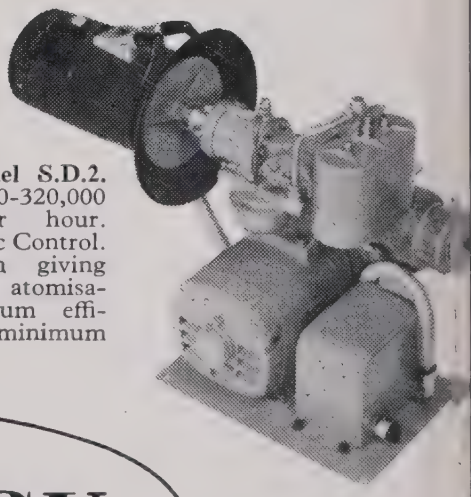
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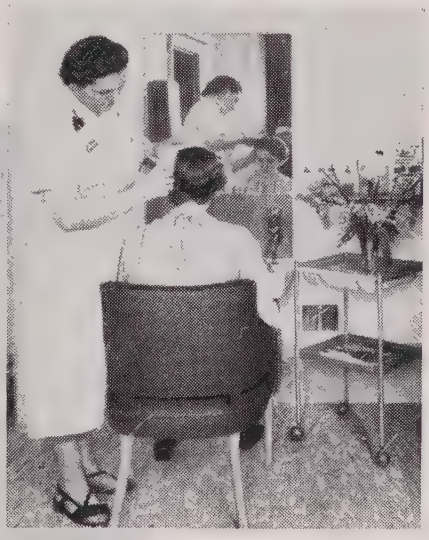


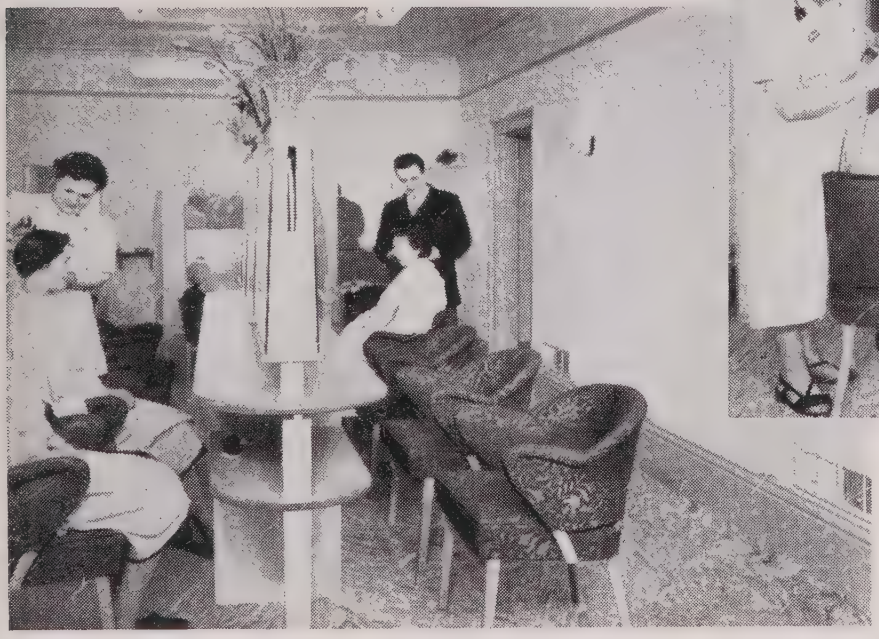
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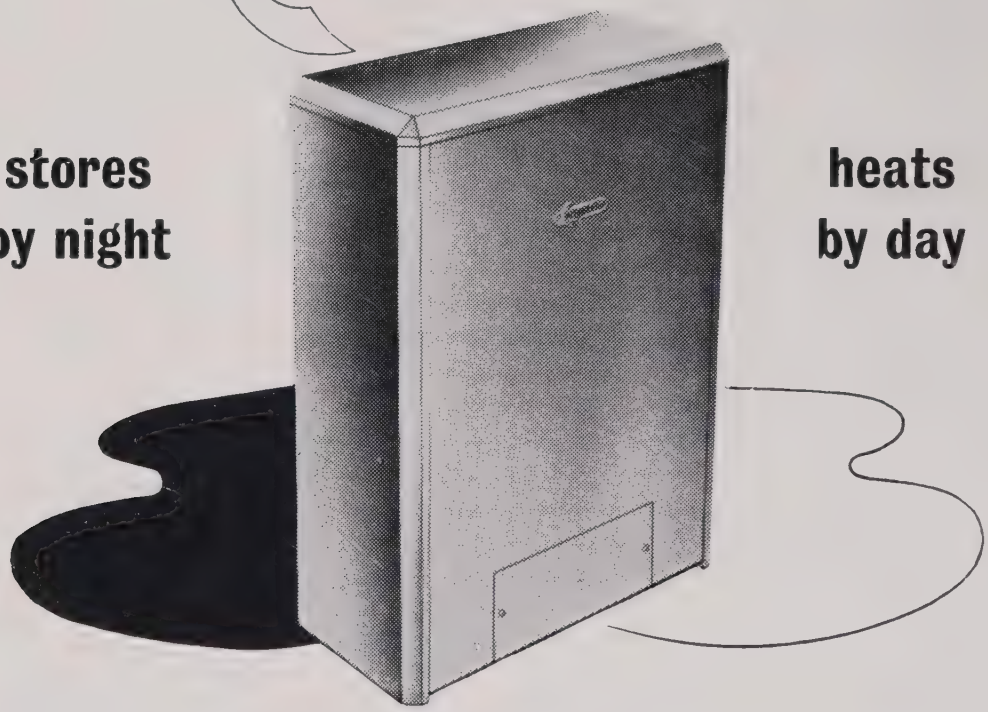
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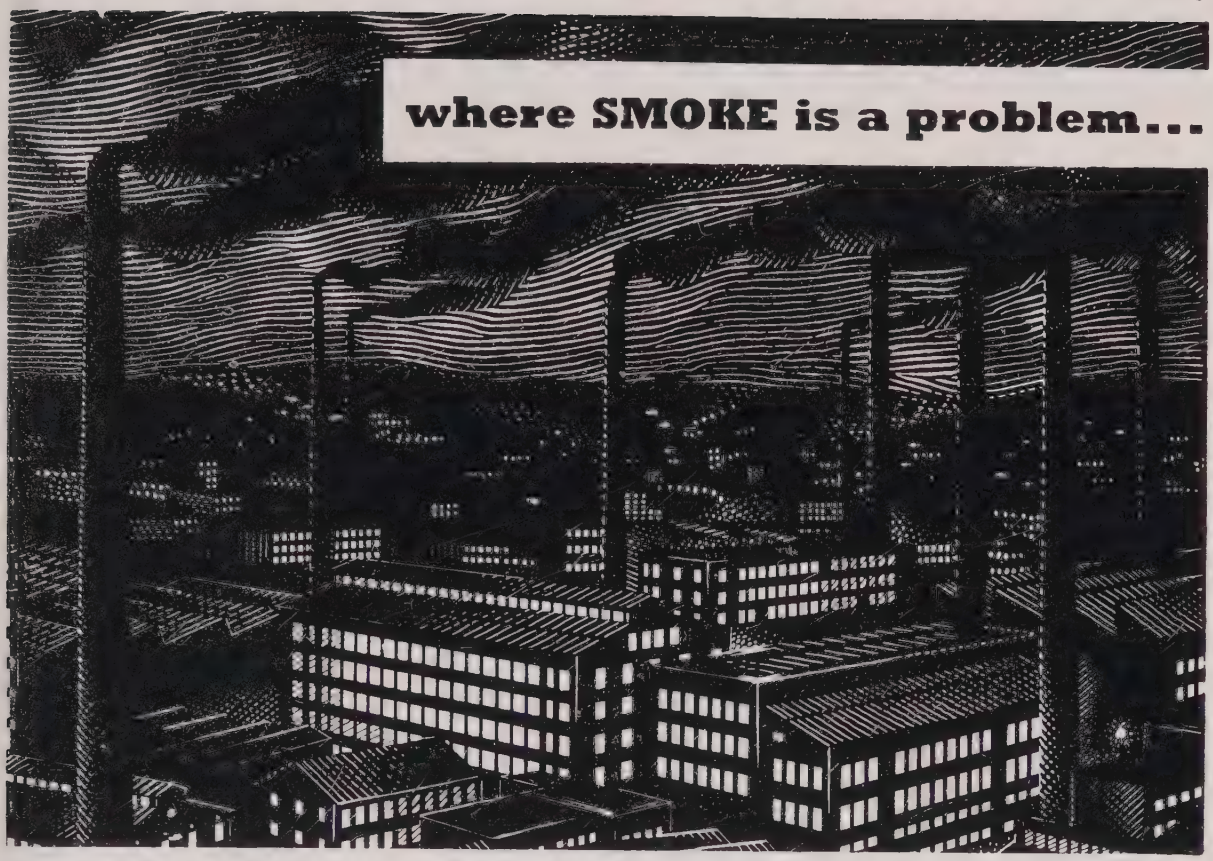
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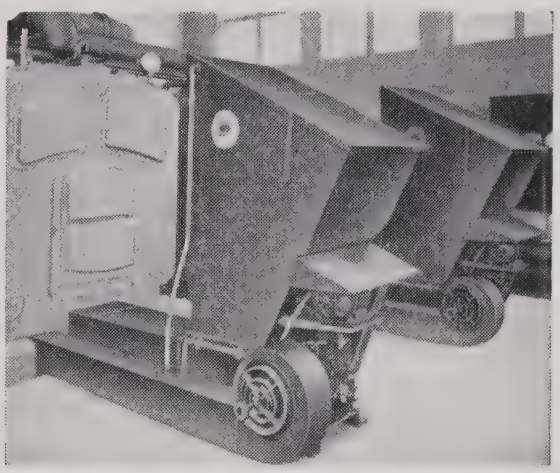
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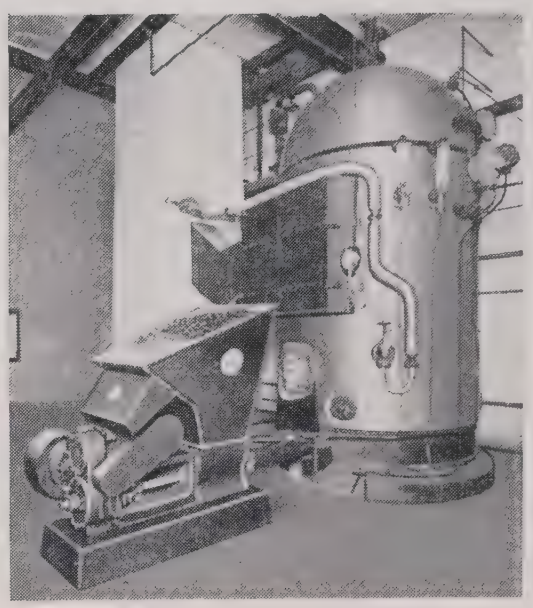
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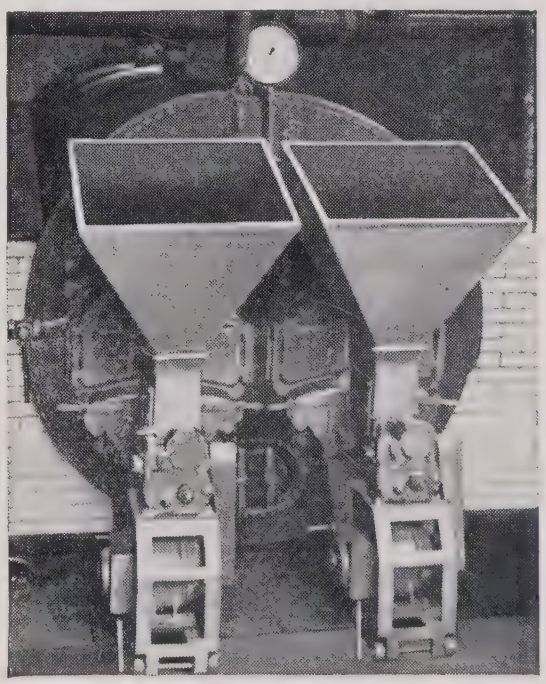
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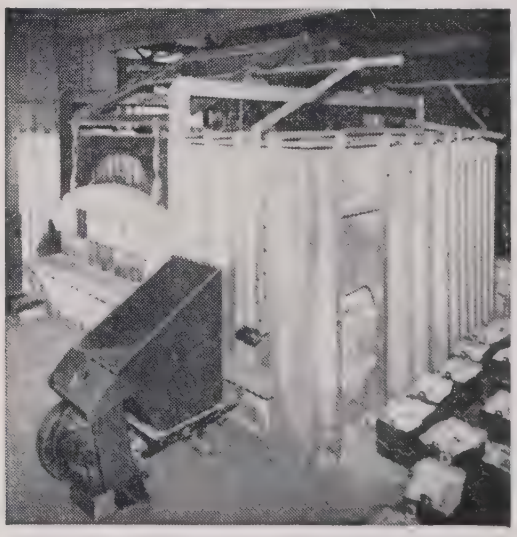
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SMOKELESS AIR

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MEMBERSHIP of the Society is invited and is open to individuals, local authorities, firms and other corporate bodies. Full details and membership application form will be sent on request.

N.S.A.S. Notices

The **Proceedings of the Bournemouth Conference, 1955,** will be ready shortly. It will contain all papers and discussions in full, including the Des Vœux Lecture and a verbatim record of the " Any Questions on the Clean Air Bill " session by the Rt. Hon. Alfred Robens, M.P., and Gerald Nabarro, M.P. *Price* 12s. 6d. post-free.

The Clean Air Bill Debate. A limited number of copies of Hansard for November 3rd, 1955, containing the Second Reading Debate in the House of Commons, are available. *Price* 11d. post-free.

Display Material. A new descriptive list of the Society's exhibits, posters and other display material, including new items, is now available and will be sent on request.

1956 Conference. The Society's next Annual Conference will be held at Southport on Wednesday, Thursday and Friday, October 3rd, 4th and 5th, 1956.

SMOKELESS AIR



Comment

Grand Recessional

UNTIL we saw the *Manchester Guardian* on the following morning, we thought that we were being unduly sensitive in feeling that one of the most significant things about the second reading debate on the Clean Air Bill was, not anything that was said, but the way in which the House emptied as soon as the debate began. But the *Guardian's* more experienced Parliamentary Correspondent began his report, under the headline: " Clean Air Bill. Clearing the Commons," by saying:

> " ' Clean Air Bill ' called the Speaker in the House of Commons yesterday and the grand recessional began. The Opposition Front Bench was swept clear of everybody but Dr. Edith Summerskill. It was almost a stampede."

The Government Front Bench was a little better, but on both sides the handful of members who sat through the debate appeared to be confined to those who wished to speak in it. The incident seemed to show, once again, that clean air is a subject which all, more or less, and quite passively, approve, but in which very few indeed are interested. This can certainly be said of the general public, and Parliament is after all simply a reflection of public opinion.

Because of the Clean Air Bill we have reached a peak of interest in our problem, but it is a peak only for the small minority of people who are directly concerned. Compared with other public issues it remains but a minor hill. It is, however, our own particular peak, and already it is time to think of what lies beyond it. More and higher peaks, or a descent to the plains? Much will depend on how well the Bill is strengthened as it goes through the Committee stage, and much on how well the efforts of the last two or three years are sustained by those who have the movement truly at heart. With the Act will come the practical problems and difficulties, and as is the nature of things, frustrations and disappointments.

Whether there will, or will not, be a grand recessional in the movement itself will depend more than anything else on the spirit of the few who, among their other services for clean air, have for so long sustained the Society. As this is written a trade association that has subscribed a few guineas a year to the Society has told us that it is going to drop its membership because now that the Government has taken over the job there will be no further work for the Society to do! Just as much as they are doing now, the Government took it over in 1926, and before that in 1875, and indeed right back in 1306! One further step in legislation is not going to lessen, but will in fact increase, the need for a body such as the N.S.A.S. We reprint on another page some excerpts from the President's address at Bournemouth on the tasks now facing the Society, and reference is also made to a new appeal to local authorities for the funds we need to do this work.

Amending the Bill

The Second reading, and especially the Minister's winding-up speech, clarified a few details about the Bill, while other speakers—and especially Mr. Nabarro—underlined some of the major criticisms. By the time this journal appears the Committee stage may be starting, or may even be concluding, and yet at the time of going to press it is not possible to detail the amendments the Society wishes to see accepted. The Second reading debate was considered by a meeting of the

Executive Council on 11th November, at which a number of points were remitted to the Technical Committee for more detailed examination and action at a meeting to be held while this issue is printing. It may however be of interest to mention that there are 42 distinct points on the Committee's agenda.

Perhaps the most serious and most widely expressed criticism of the Bill is on the defence clauses of Section 2, and particularly that relating to " unsuitable fuel." Another unfortunate feature of the Bill, as it now stands, is that it repeals byelaws made under the 1926 and 1936 Acts, which, *without providing any defences*, made the emission of black smoke for more than two or three minutes in thirty, an offence. Under the Bill black smoke will be provided with a set of defences that will materially increase the difficulties of every case.

The continued privilege given to Crown property, against which action cannot be taken, is a matter of disquiet, especially as it is understood that hospitals—so frequently offenders—are now regarded as Crown property. On the matter of the special cases the " Nabarro compromise "—control to be in the hands of the local authority if it can show that it has suitable technical staff—appears to be gaining support, particularly since the Minister announced that the number of new Alkali Inspectors envisaged was only ten.

The Sulphur Fallacy

The absurd theory that the prevention of smoke is useless because only sulphur dioxide matters, was expressed in woollier than usual terms in the debate, with Mr. Hobson, M.P. for Keighley, taking first place by his fantastic declaration that " pollution is infinitely greater in the smokeless zones than pollution with black smoke." A few days later *The Times* published a most odd and confused letter from a Dr. Godsalve Ward, who argued that health will deteriorate if we sit over coke fires, that the smoke deposits in the lungs are innocuous (though good for the garden!), that " the sulphur acids in smog are what do the damage," and that " we doctors always turn gas and coke fires out of sick rooms, especially for chest cases." A brief, but sharp, reply from the Director of the Society was published the next day, and was followed by a spate of most valuable contributions, including a notable expression of the ill-health consequences of coal smoke from Dr. J. L. Burn of Salford. On the other hand, it was revealing to note, Dr. Godsalve Ward's letter was hailed by the *Coal Merchant and Shipper* as the view of an eminent medical man, while the Secretary of the Chamber of Coal Traders seized the opportunity to try to show that domestic smoke was of little importance, and that " the inherent commonsense of the British people is asserting itself against the extremism of the prohibitionists." We welcome all this: a little opposition is a useful stimulant.

To Mr. Hobson, who has been sadly led astray, we sent a copy of the Summer, 1955, issue of *Smokeless Air*, drawing his attention to the article which analysed in some detail the fallacy that sulphur is the one serious factor in air pollution. We said we would be glad to have any evidence that contradicted our conclusions, but so far Mr. Hobson has only acknowledged our letter. What good this particular red herring does to anyone we cannot see. Every one acknowledges the seriousness of the sulphur problem, but it will not help to solve it by doing nothing about smoke. And to say that smokeless fuels do not improve things is of course to argue that the part is as great as (or greater than, according to Mr. Hobson) the whole.

The St. Pancras Case

The action taken in St. Pancras in respect of railway smoke is reported on another page. Here we wish to comment on the view expressed by the magistrate that if a public authority is fined it is in effect the British public that pays, and what was the sense of

that? A number of informed comments have shown how dangerous and mistaken a doctrine this is, and that it does not bear extension. What is the sense, it might be asked, of a gas works manager having to pay a railway fare when he travels to London on business, or of Hobart House paying its electricity bill? Then, since the funds of a private company come ultimately from the public, why should they not be similarly considered? Commenting on the magistrate's view, *The Times* admirably said:

> " Every public corporation stands or falls on its own financial responsibility. Their separate costs of operation are fundamental and legal costs and legal penalties are part and parcel of their general expenditure. The full independent financial responsibility of public undertakings, down to their smallest fine or their smallest liability in a civil action, should not be questioned."

We earlier referred to the exclusion of Crown property from action under the clean air legislation, and might go further by asking why one kind of public property should not be dealt with as another kind? What is the real, as distinct from the purely legal, difference between the boilerhouse of a hospital and that of a coal mine?

The Society's Officers

Because of the death of Lord Horder, the President-elect, the Executive Council invited Sir Ernest Smith to continue as President for a further year. Sir Ernest accepted the invitation, and the action taken was warmly endorsed by the annual general meeting at Bournemouth. New Vice-Presidents are Alderman J. J. Milton, of Bristol, Mr. James Law, formerly Chief Inspector to the Sheffield, Rotherham and District Smoke Abatement Committee and for many years a valued member of the Executive Council, and Dr. W. R. Martine, of Birmingham. Dr. Martine had served as Chairman of the Executive for the last two years, and has been succeeded in this position by Mr. F. J. Redstone, at Bristol. Two new Deputy Chairmen were also elected: Dr. J. S. G. Burnett, M.O.H. of Preston, and Mr. John Innes, President of the Society's Scottish Division and C.S.I. for Paisley.

Boiler House Certificate Success

The City and Guilds of London Institute has announced that the 1955 summer examination for the Certificate has now been completed. The entry showed a satisfactory increase from 700 in 1954 to 866 in 1955. This increase is the more significant in that the 1954 examination was the first national examination of its kind and the entry included many candidates who had been waiting for some years for the opportunity to sit. A most encouraging feature of the 1955 examination is that, despite the large entry, slightly more than 82 per cent of the candidates passed the examination.

The examination is strongly supported by the National Coal Board and the Central Electricity Authority, who themselves provided 164 and 324 candidates respectively. N.I.F.E.S. is both arranging courses to prepare boiler operatives for the examination and encouraging the establishment of courses at technical colleges throughout the country.

Stop Press

As we go to press it can be reported that the meeting of the Technical Committee, referred to above, agreed to seek to have the Clean Air Bill strengthened by some 40 amendments. These range from minor but important details of drafting and interpretation, to major changes. Thus amendment of the " escape clauses " is urged, and the inclusion of the Model Clause regulating the height of chimneys, is sought. It is also desired that the importance of sulphur oxide fumes should be recognized by some direct reference to them in the Bill. No recommendation was made on the administrative " special cases " provisions.

The Bournemouth Conference

TWO DELEGATES' IMPRESSIONS

THE annual conference in Bournemouth at the end of September was regarded, according to all comments we have heard, as a great success. It certainly broke all records, with an attendance of 578 members and delegates. The papers and discussions were of a high standard, and will shortly be available in volume form as *The Proceedings of the Bournemouth Conference*, 1955. (Price: 12s. 6d.).

We print below a personal impression—amusing and perceptive—of a member who was attending for the first time, and the report to his Health Committee of Councillor Dr. J. K. Ashworth, a delegate from St. Marylebone. We have always wanted to know what sort of reports on our conference were made to the local authorities, and are glad to have the opportunity of publishing one. It will be of interest both to those who were present and those who were not.

I. Some Personal Impressions

To be frank, what most impressed me at the Bournemouth Conference was Bournemouth itself: the sparkling façades of the buildings, the opulent splendour of the shops, the gay profusion of the flower beds, the fetching chic of the girls—not that, one hastens to add, they outshone the visiting smoke abatement ladies—all so bright and sparkling in the smokeless air, just like the photo in the summer Smoke Abatement Journal. It was a great advertisement for the goods the Society has offered for sale during half a century, and has now begun to sell in a big way.

But to come to the Conference itself. Three general impressions stand out in my mind. First, the devotion to the cause of clean air manifest throughout the delegates: this, one supposes, is the way in which good social causes get advanced in a democratic community. Second, however, how different was the apparent measure of knowledge of the subject between one delegate and another. Third, the smooth efficiency with which the Society's staff organized and ran the Conference. One is so familiar with the wonder of the amount of good work done by so few people that one ceases to marvel. All the same, it is a marvel.

To turn to the details of the programme, the President's opening address was sage and commonsensical, deftly pointing the way ahead for the Society in a community slowly waking up to the need for clean air. The Nabarro-Robens Brains Trust was good clean air fun. One was impressed by their ability spontaneously to give satisfactory answers to tricky questions, and encouraged by the demonstration that the clean air problem is not, in fact, to be the toy of party politics. It looks as though everybody will turn—perhaps with undue ferocity—on the Minister of Housing to improve and still further improve the Clean Air Bill.

The papers on domestic heating were full of interest. But perhaps the Conference was less excited than it might have been because of an appreciation that these novel and attractive

methods for providing full, efficient, automatic and smokeless domestic heating are, in this imperfect world, likely to come the way only of a favoured minority.

The session on the Clean Air Bill left one with an uneasy feeling that too few of the delegates had studied the Clean Air Bill itself, and too many had formed their opinions from commentaries. There was some misconception of what the Bill does provide, and its various loopholes seem to be greatly magnified in the interpretation of a number of speakers. However, why be satisfied with less than the best?

Finally, Dr. Parker's address added some new items to the familiar category of material damage by smoke. For instance, those distinguished armchairs. Now we understand the posture and expression of their comatose occupants. Its the acid in those seats!

II.—A Report

To begin with, may I say that I found it difficult to reconcile the (literally, or physically) breath-taking climbs from the centre of Bournemouth with its reputation as a place in which to convalesce or to reside in the years of life in which one is a trifle " gone in the wind " by the natural encroachment of anno domini?

My general impression was that the Conference appeared to be rather obsessed and depressed by the multiple escape clauses in the draft Bill, and this undertone coloured the entire conference.

Your representative took part in the discussion on September 29th on the subject and pleaded for a more



The Bournemouth Conference in Session. A smoke haze over the delegates made photography more difficult

optimistic view, on the grounds that the Bill, if not ideal would, at least, when law, have some deterrent effect on Clean Air polluters, especially if backed by the force of public opinion.

The " Any Questions " panel of Mr. Nabarro, M.P. and the Rt. Hon. Alfred Robens, M.P., was most instructive and the following points were brought out. Our present importation of coal and oil is in the region of 12,000,000 tons per annum at a cost of £80 million per annum. Mr. Nabarro made a point that what is necessary is to make coal work harder, *i.e.*, to make better use in a non-bituminous manner of all that is hewn by the miner. At present 42,000,000 tons of coal is used annually by the Electricity Authority and the output of phurnacite by the Coal Board is 400,000 tons, and of other solid smokeless fuels, 1,000,000 tons per annum. A speaker from the Coal Board stated that by new processes the output of coke and anthracite will be increased annually by 1,000,000 tons per annum as from next year.

Another interesting point which emerged was on the question of fumes from diesel driven vehicles. There is no reference to this menace in the Bill because it is provided for in the present Road Transport and Traffic Acts. The weakness is that the police are unwilling to use their powers already in existence. Another point that was made is that Local Authority Planning Committees should insist on inquiring carefully into the heating and fuel storage systems of all proposed new buildings.

The afternoon of Wednesday, September 28th was devoted to technical papers on recent progress in domestic heating by centralized methods. As a lay objective observer it was clear that solid smokeless fuels still provide the cheapest alternative to bituminous coal but that their use still entails a certain amount of dust in the home and of extra work for the housewife. One speaker made a plea for planning for the 21st Century and suggested that by that time no housewife should have to handle hods of solid fuel or be burdened by cleaning grates. I recommend that the Housing Committee should be given the opportunity of perusing these papers.

On the following day Mr. Nonhebel pointed out that the bar space of fires for burning coke should be wider than the Gas Council recommendation of $\frac{5}{8}$ inch or $\frac{11}{16}$ inch. It is suggested that this point should be recommended to all property owners who may have to make changes and adaptations in their existing grates.

Thursday, September 29th, was entirely devoted to discussion on local authorities, the Beaver Report and the Government Clean Air Bill.

The following points which seemed important were made by Mr. Moss of the Coal Utilization Council:

1. Central control of fuel allocation must be a *sine qua non* prior to the establishment by a local authority of a smokeless zone.
2. Mechanical stokers, properly used, can use bituminous coal efficiently. At the moment only 35,000,000 tons of solid smokless fuel are available for industrial purposes and only 5,000,000 tons for domestic purposes.
3. It would be a tactical mistake to force people to use gas for lighting domestic fires, especially in houses where gas is not at present used.

A speaker from Birmingham stressed the necessity to press the Minister for the establishment of a Clean Air Advisory Council similar to that existing in the other branches of fuel industries. A further suggestion which seemed to be well received by the meeting was that the Minister should call for annual progress reports by all local authorities on their efforts to promote clean air in their areas. This, apart from anything else, would ensure a healthy measure of competition towards obtaining the desired object of Clean Air.

The Chairman of the Public Health Committee of St. Pancras made a sustained attack on railway smoke and I feel that the Council should, as



The President, Sir Ernest Smith, being interviewed at Bournemouth for an I.T.A. newsreel feature. The interviewer is Miss Lynne Reid Banks

they have previously done, join with the neighbouring boroughs in expressing their disappointment in the provisions of the Bill dealing with railway smoke to all who may be able to influence a change in the Bill during the Committee stage.

Arising from this, it seems to me that if there is no prospect of obtaining permission to declare St. Marylebone a smokeless zone in the near future, it might well be advantageous for the Council to set up a Standing Joint Committee with the neighbouring boroughs and, in particular, Hampstead, Paddington, St. Pancras and Islington, to try to obtain ministerial sanction for smokeless zones for part or whole of these boroughs at the same time.

Finally, it became clear that the Council should start immediately a survey of the Borough to assess the cost of conversion of domestic appliances on the lines indicated in the Clean Air Bill. Even if the financial provisions are altered in the Committee stage the Council should be in a position (before the Bill becomes law) to know the number of grates to be converted.

The Des Voeux Memorial Lecture gave excellent illustrations of the destructive effects of air pollution on materials, e.g. stone, iron, leather, fabrics, etc., etc. Mr. Nabarro stated that the damage caused in this connection by air pollution amounts to approximately £500 thousand per annum in a town with a population of fifty thousand inhabitants, i.e. £10 per annum per head of the population.

It seems that even although conversion to a smokeless zone will be slightly more costly in actual outlay to the residents yet it is obvious that a saving of £40 per annum for a family of four people in materials should offset this disadvantage without even considering the inestimable advantage to health of Clean Air.

The Platform at Bournemouth



Mr. Gerald Nabarro, the Mayor of Bournemouth (Cllr. D. N. Willoughby), Sir Ernest Smith, Mr. Alfred Robens, Dr. Martine



Dr. R. Lessing makes his Chairman's remarks



Dr. J. L. Burn addressing the meeting



Miss A. D. Boyd speaking; Dr. G. E. Foxwell on the right

The Society's Need to Develop

£12,000 p.a. More is Wanted

The President, Sir Ernest Smith, included in his address at the Bournemouth conference a review of the work ahead of the Society with the coming of the Clean Air Act. He gave a list of seven tasks which, among others, " can often be undertaken only by the Society because of its independence, experience and repute." They were, he said:

(1) To observe, discuss and where necessary make representations about the working of the new Act.

(2) To assist, especially in publicity and education, the more active local authorities.

(3) To continue to educate and ginger-up the inactive local authorities.

(4) To note, and if necessary criticize, the way the Government departments are doing their part, and to assist them in any way.

(5) To continue to publicize the problem and to educate—and be of service to—the public and industry generally.

(6) To encourage research and developments and to help to make their results known and used.

(7) To continue to act, as we are doing already, though probably to a steadily increasing degree, as a centre for information that is freely available to all.

Now these things cannot be done effectively unless the Society's funds, which have always been so restricted, can be considerably augmented. If the points listed by the President are examined it will be seen that numbers 2, 3, 5 and 7 require expenditure which, while it need not be on any ambitious scale, must be much higher than can be afforded on the present annual income—which has not yet quite reached the £9,000 mark.

The main lines of development called for are not theoretical but extensions and a strengthening of work that is already being done in a strained and restricted way. The principal needs are in fact to augment the small headquarters staff of six persons; to improve and extend regional activities; and to be able to make more use of outside services (e.g., for publicity purposes). This development should be directed especially for the following purposes:

Publicity Services—exhibitions, and loan of exhibits, posters, etc.

Lecture Services—speakers, lecture notes and aids, slides and film strips; organization of lectures.

Publications—Extended range and supplies for educational distribution.

Smokeless Air—Development and issue at more frequent intervals.

Press Publicity—Organization of news, features, letters, etc., especially to local papers and in connection with local efforts.

Regional Organization—especially for exhibitions, lectures, press liaison, etc.

To develop these activities to a reasonably efficient extent will require at least an annual income of £20,000—say £12,000 a year more. A further stage, to £30,000, can be envisaged, but no thought is being given at present to the education and propaganda work that would send costs far above these modest figures—films, press and poster advertising, permanent or travelling exhibitions, and the like.

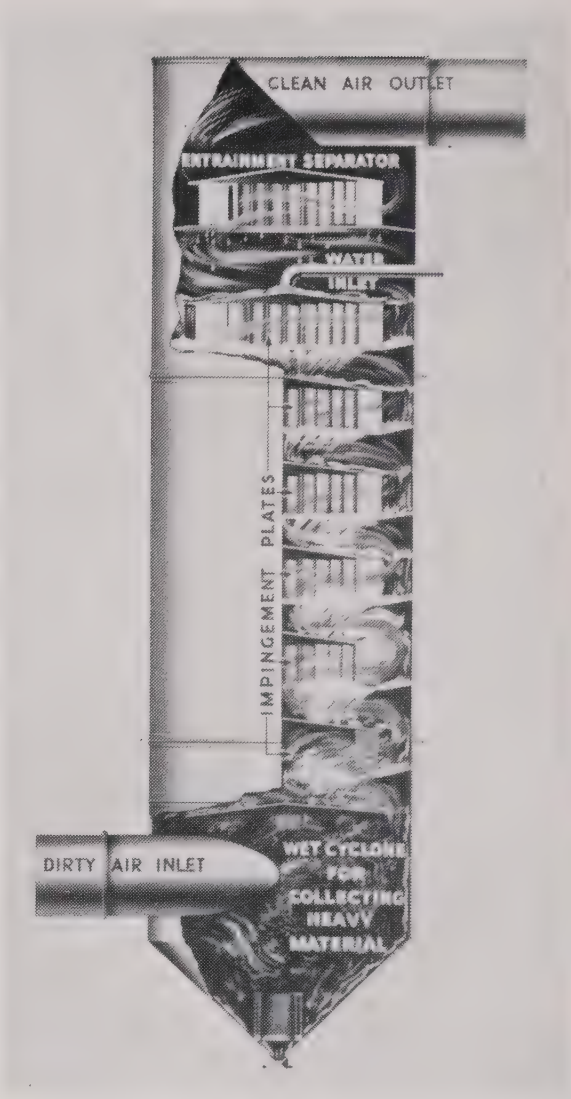
To whom can the Society appeal for funds? The Government has so far refused to make a grant to our work, although the amounts involved would hardly make a ripple on the national budget. Industry, which already contributes more than half the present income, could do so without difficulty, and may have to be asked.

It is, however, to the local authorities that it is felt the appeal should be made in the first instance. This is not without just cause. The services to be developed are very largely those asked for, more and more, by local authorities, and on which the Clean

(*concluded at foot of next page*)

Multi-Wash

W. C. Holmes and Co. Ltd., of Huddersfield, have introduced the complete Schneible Multi-Wash system to this country. It can be adapted and applied to many different dust-collecting and gas washing problems, including for example the removal of dust and cinders from cupola stacks, and fumes in varnish and paint making, rubber and plastic processes. One type of collector is shown in the illustration—the washing agent, usually water, is introduced at no head pressure above the centre of the top impingement plate, gravity causing the water to flow downward against the upward flow of the rapidly rotating air current. The rotary motion of the ascending air sets up a similar motion in the descending water causing it to be cascaded evenly over the discs, vanes, shelves and side walls of the collector. This violent whirling agitation forces the liquid off the edges of each of the discs and shelves in a finely divided heavy water curtain, through which the air must pass. This combination of water curtain, spray and impingement action envelopes the particles of dust rising with the air and carries them down into the cone and out of the collector. The clean air passes through the entrainment separator located at the top of the tower, where it is freed from excess moisture which drips down on to the top impingement plate.



Full details can be obtained from W. C. Holmes & Co. Ltd., P.O. Box B.7, Turnbridge, Huddersfield.

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concluded from page 87

Air Act will empower them to spend money. And it is the local authorities who, because they constitute a majority of the members of the Society, can both guide and watch over the way the proposed development progresses.

It would, of course, mean a considerable increase in their subscriptions. At present they subscribe from three to thirty guineas, according to population, and together contribute nearly £3,000, or just on one-third of the total income. To bring this up by £12,000 means asking them to increase their subscriptions by four or five fold, which is a lot. Is such an appeal likely to succeed? It would mean subscriptions ranging from 12 to 15 up to perhaps 150 guineas. We are well aware of the difficulties: the many calls on local authorities from other worthy causes, the present financial problems, and so on. But what is suggested is, after all, but an insignificant proportion of what should be spent on securing clean air, and which will *have* to be spent if we are to get it.

CHIMNEYS AND THE DISPERSAL OF SMOKE

By J. E. Hawkins, B.A., and G. Nonhebel, B.A., B.Sc., F.R.I.C., F.Inst.F.

This paper, read to the Institute of Fuel in London on 9th November, is to a large extent of a highly technical nature, and we give only the conclusions reached by the authors, together with extracts from the section dealing with flue gas washing. This is an apt commentary on the article by R. S. Scorer published in our last issue.

THE conclusions that may be drawn from this review of current knowledge on the dispersion of gas from chimneys, and which should be applied by those concerned with the design of new plants, are:

(1) Down-draughts of flue gases from chimneys should be avoided by choice of height of chimney. As a general rule, chimneys should be at least $2\frac{1}{2}$ times the height of adjacent buildings, but in a factory or built-up area with many high buildings, or in a valley, or where the ground is uneven, it is highly desirable to check by means of wind-tunnel tests that the chimney has sufficient height.

(2) The velocity of discharge of flue gases from the chimney mouth and the shape of the chimney mouth must be such that flue gases are not carried downwards by the eddies made by the passage of wind past the chimney and into the area of down-draughts caused by the surrounding buildings.

(3) Formulae have been deduced from theoretical considerations which enable the effect on ground-level concentration of the relevant design factors to be compared. With these formulae it is possible to calculate the maximum ground-level concentration of constituents of the flue gas with enough precision to enable the designer to decide whether the chimney height and the gas temperature are high enough to disperse the gases adequately. In many cases the value of the maximum concentration is not an adequate measure of the effects at ground level of gaseous discharges and, in built-up areas especially, some estimate is necessary of the area over which perceptible concentrations may occur. Ground-level concentrations so calculated are confirmed by a few observations to within a factor of about 2, but further observations need to be taken. It will readily be understood that the physiological and corrosive effects of very dilute concentrations of gases and dusts are equally uncertain. Nevertheless, if, for example, it is decided that the ground-level concentration of sulphur dioxide from a large fuel-burning installation should not exceed 0·1 p.p.m. because concentrations above this are harmful to certain grasses, it is desirable to show by calculation that the installation will not produce these conditions.

(4) It is similarly possible to calculate rates of dust deposition from a chimney, given a knowledge of the size grading of the dust in the discharge, and to relate this with known rates of deposition in the district.

(5) Theory and observation show that the use of one instead of several chimneys for discharge of hot flue gases from a battery of furnaces increases the effective height of emission and so decreases the ground-level concentration. Conversely, when plant extensions are made, the use of one new chimney to carry all the gases from both old and new plant may enable a fourfold increase in the discharge to be made while the ground-level concentration goes up by only 50 per cent. The rate of deposition of fine dust from some old power stations

with short chimneys on each boiler has in fact been greatly reduced by discharging the flue gases from the whole plant through one or two high chimneys.

Effect of Gas Washing

At two large London power stations, the major part of the sulphur in the flue gases is removed by a once-through washing process which reduces the temperature of the gas (to within a few degrees of river-water temperature) and saturates it with water vapour. This process has been criticized on the grounds that the washed plume loses much of its thermal buoyancy and spreads to the ground much more quickly than the unwashed plume, so that the maximum concentration due to the washed plume is comparable to that due to an unwashed plume even though 90 per cent or more of the sulphur dioxide has been removed by washing.

Calculations (by methods set out in this paper) indicate that the reduction by washing of maximum ground-level concentration is proportionately less than the reduction in sulphur emission, but that for chimneys at existing large power stations (e.g. Battersea) a washing process of high efficiency (say, 90 per cent or more) will reduce the maximum concentration in average conditions by an appreciable amount. But it must be remembered that the concentrations discussed in this paper are time-average concentrations and it may be that gas washing, while reducing the time-mean concentration, increases the chance of occasionally receiving a whiff of concentrated flue gas at the ground.

Barad and Shorr describe measurements of the frequency and position of such puffs made in super-adiabatic, i.e., unstable, conditions. The observations were made on an oil-fog aerosol discharged at a height of 185 ft. from a tower. An average frequency of one puff at ground level per 2 min. was noted and it was found that puffs reached the ground immediately downwind from the tower at locations where the time-average concentration of aerosol was negligible. As has been pointed out, the irregular wavy appearance of the smoke plume suggests that near the chimney the instantaneous concentration can vary from zero to a high value in a matter of seconds. Any reduction of height of rise by gas washing must, of course, bring the point of maximum concentration nearer the chimney, and so nearer the region where the fluctuations of concentration are very marked. With gas washing the effects of downdraught and gustiness and of slight inversions are also more frequently noticeable, as discussed by Rees.

But an advantage of gas washing which is rarely appreciated is the reduction of area affected by high concentrations of sulphur dioxide. There is the additional advantage that gas washing removes most of the residual dust passing through the dust collector of a pulverized-fuel boiler plant, and consequently little or no dust is visible in the path of the flue gases after the steamy cloud issuing from the chimney has been evaporated. The fine dust from a large plant without gas washing can be seen for many miles on a clear day and, of course, dust particles interfere with the beneficial effects of daylight while they are airborne and, if they deposit on vegetation or glazing, when they have settled. Consequently when gas washing is installed it must be credited with some reduction of one of the less obvious effects of smoke in the atmosphere; that is, the obscuration of sunlight by fine dust.

It may be relevant here to describe the important difference between what are called "effluent" and "non-effluent" washing processes. At Battersea and Bankside power stations the washing liquor is passed once through the gas scrubbers and is then discharged to the Thames. This is an effluent process and a large quantity of heat is removed from the flue gas and carried into the river. Restrictions on discharges into rivers make it certain that if gas washing were widely used at inland power stations, the effluent processes would not be poss-

ible and a non-effluent process would have to be employed. In a non-effluent process such as that employed before World War II at Fulham power station, the washing liquor is continuously recirculated and the only heat loss from the flue gas is caused by the heating-up of a small quantity of make-up water and by the discharge of a sulphur compound in the form of a warm sludge. The temperature of the gas is reduced as it passes through the scrubber, to its wet-bulb temperature (about 50° C. for flue gases from large boilers). but it retains most of its heat in the form of latent heat of water vapour evaporated from the wash liquor. If the relative humidity of the atmosphere is 100 per cent. most of the water vapour in the plume must condense as fine mist and liberate its latent heat. It has been argued, therefore, that under these conditions the thermal buoyancy and hence the thermal rise of the plume is not reduced by washing. But in average conditions the relative humidity of the atmosphere is about 80 per cent and, although there is some release of latent heat near the chimney, the thermal buoyancy of the washed plume is never likely to be more than one-half of that of an unwashed plume.

A non-effluent washing process has the advantage, compared with an effluent process, that the gas cools down to its wet-bulb temperature and then no further, whereas in an effluent plant the gases may be cooled a further 40° C. Unwashed flue gas at 150° C. contains about 0·05 lb. of water vapour per lb. of dry gas. Its wet-bulb temperature is 54° C. and at this temperature the saturated gas contains about 0·1 lb. of water vapour per lb. of dry gas. In fact, at Fulham power station before the war the gases left the scrubbers of the non-effluent washer at 50° to 55° C.

In the present state of knowledge it seems fair to summarize the merits of gas washing by saying that it probably reduces the average concentration of sulphur dioxide at ground level over large areas remote from the chimney, but that it may (particularly with effluent processes) lead to occasional puffs of moist, concentrated, washed flue-gas at ground level near the chimney. Nevertheless, the sulphur-removal efficiency at Fulham in 1937 and 1938 was 97 per cent: this efficiency could be raised appreciably by application of improved chemical engineering technique developed since then. Emission of fine dust is very much reduced by gas washing.

Marylebone Clean Air Campaign

On 4th October the Borough of St. Marylebone's Clean Air Campaign was formally opened by the Deputy Mayor (Councillor Robert Sharp). After the announcement of the City of London's smokeless zone, St. Marylebone aims to be the first London borough to take up the cause of clean air and no smoking chimneys. In the Central Library a small exhibition was staged, including N.S.A.S. exhibits and pieces of stone from Westminster Abbey showing the smoke corrosion, while outside the Town Hall the mobile exhibition of the Solid Smokeless Fuels Federation attracted considerable notice.

In welcoming the guests the Deputy Mayor said that the Mayor, who was unable to be present, was a firm believer in clean air for St. Marylebone. He also said that although there were few industrial properties in the borough, they had three black spots which caused disquiet, namely the marshalling yard, the railway station and the power stations.

Sir Hugh Beaver referred to the 1952 smog, and to the cost of smoke, and said that the public must be taught that clean air was as important as clean water.

Air Chief Marshal Sir Leslie Hollinghurst said that there had been 24 complaints of industrial smoke from the W.1 area, but not one stoker in the area had gone in for the proper stoking course.

The Gas Council Report

The Gas Council has again produced a most interesting and informative report. It underlines heavily the national dilemma—increasing demand for fuel and decreasing supply—and suggests that the two primary considerations are:

(1) that the existing stocks of coal, our main supply of fuel, are used to the best advantage;

(2) that research on new sources of fuel and energy be pressed vigorously. According to the Report it is the declared policy of the Gas Council to guide future development with these two fundamental principles in mind.

With regard to the first, the industry aims at the production of the maximum possible quantity of gas coke for use as a smokeless fuel. In this connection it is heartening to see that research is proceeding directed to the improvement of quality as well as quantity. Of particular interest is the work on such questions as sizing, moisture content, " flying " shale, and " combustibility." Attempts are also being made to replace with other fuels some of the coke used for the production of water gas and producer gas. A problem as yet unsolved is the difficulty of transport of coke for the home market. Industrial consumers normally carry large stocks, and deliveries are made throughout the year. Domestic consumers, however, are sometimes unable to carry a stock of more than about 5 cwt., and even those who can store more than this frequently postpone the ordering of fuel until winter has arrived. " Inability to meet a demand for coke immediately," says the Report, " has often been due to difficulties of transport rather than to shortage of supplies." Obviously this is a problem which can be solved only by co-operation between the landlord (local authority or private), the tenant, and the coke supplier.

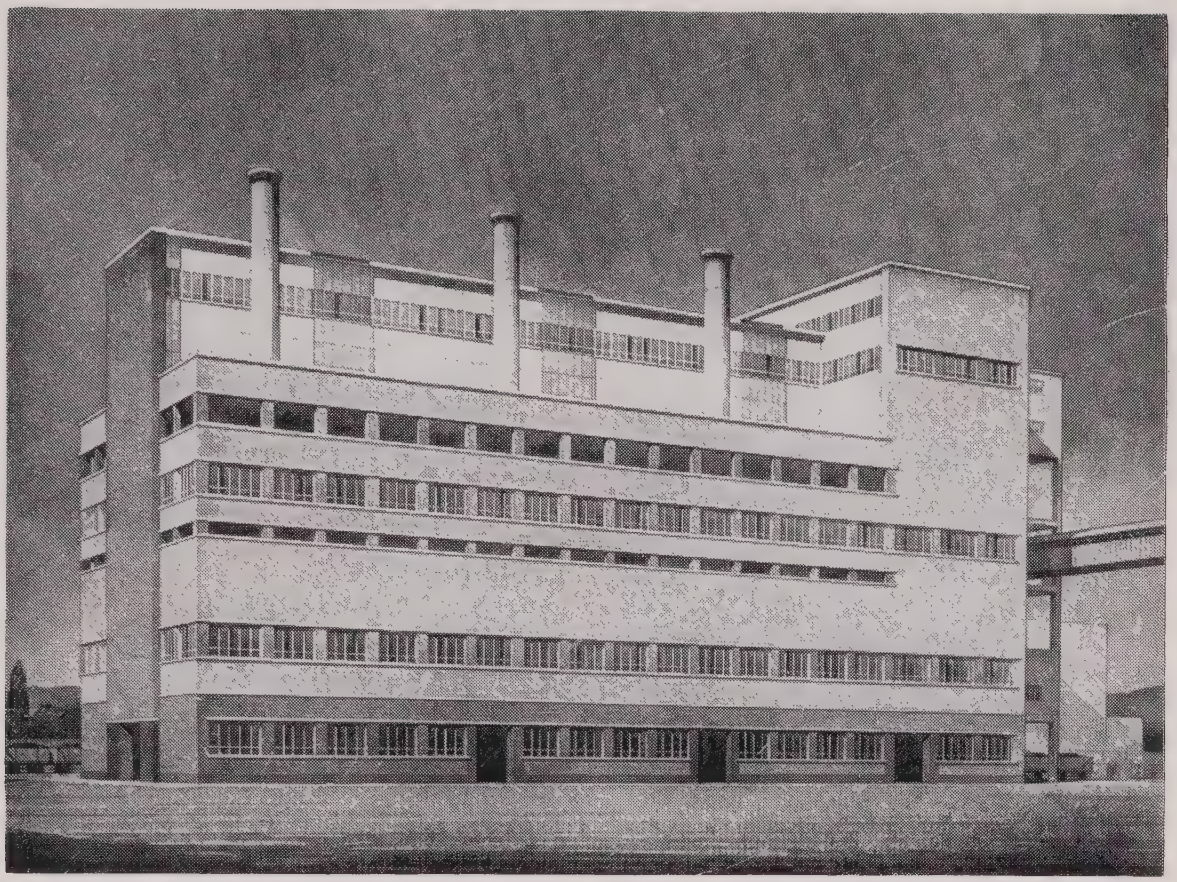
Another useful development is the improvement convector gas fires which should make possible a 25 per cent saving in gas consumption. Four new fires of this type have already been produced by manufacturers.

With regard to the second guiding principle—the conduct and implementation of research—the Report indicates that work has been proceeding on carbonization processes, the briquetting of varieties of powdered coal and pitch, gas purification processes, the disposal of effluent, and to the discovery and use of new sources of gas making.

Largely because of the restricted supplies of coal made available to the industry, there was a considerable increase in the quantity of water gas manufactured. Another factor which has made increased efficiency in coal usage imperative is the very considerable increase in the cost of coal. The industry's bill for coal at the pit-head will now be approximately £47 million a year more than at the beginning of 1949. In fact, the average yield of coal gas per ton of gas carbonized was 74·8 therms, compared with 74·5 therms in 1953-54. Had efficiency not improved beyond 1948 standards, an extra $1\frac{3}{4}$ million tons of fuel would have been necessary.

Other interesting points are that record sales of appliances were achieved during the year, many of them on hire purchase. This is obviously a consequence of the rising standard of living. Gas sales also increased from 2,513·2 m. therms in 1953/54 to 2,636·3 m. therms in 1954/55—an increase of 4·9 per cent.

There has also been progress in administration. Increased production and higher efficiency has been achieved with a slightly smaller staff, there has been a steady development of facilities for education and training, and in the current year more than 9,000 employees have followed some set course



The new Installation of Woodall-Duckham Continuous Vertical Retorts to be built for the Southern Gas Board at the Cowley New Works, Oxford—*From the Gas Council Report*

of study with the assistance of the Boards.

The statistics are comprehensively analysed, and the tabulations on pages 84 *et seq.* well repay study. In the centre of the Report there are interesting photographs of new plant and applications.

Report on Alkali &c. Works, 1954

It is by no means easy to review a Report which covers a field of industrial activity as wide as that for which the Alkali Inspectors are responsible. During 1954 production levels were high throughout industry, and with one exception, this was the case in the chemical industry. Some manufacturers of sulphuric acid found difficulty in meeting demand, all cement kilns have maintained maximum production, existing coke works have been extended, and old tinplate works, which were expected to close, have been kept in production. The exception mentioned above occurred as a result of a drop in demand for superphosphate, probably due to bad weather conditions and resultant crop damage.

These high levels of supply and demand are reflected in the heavy burden of work carried by the Inspectorate, seven officers making nearly four thousand visits and conducting more than two thousand analyses. There can be no doubt whatever of the need for a considerable expansion of the Inspectorate when the Clean Air Bill is placed on the Statute Book.

In the cement industry, there has been a good deal of trouble with the operation and maintenance of electro-

static precipitators, and although some progress has been made, it is obvious from the frequency of mention of "sub-standard operation" of precipitators that there are many difficulties still to be overcome. In this connection, it is interesting to remember that about 40 per cent of the national production of cement takes place in an area only about eight square miles in extent, on the Thamesside. In this small area, kilns have been fully operated, even when the precipitators have been operating at below normal efficiency or have been under repair.

Other registered processes which have given trouble are sulphuric acid works, chemical manure works, and the processes registered under the omnibus heading of "sulphide works."

Unregistered processes which have received the attention of the Inspectors include power stations, coke works, gas works, metallurgical works, lime crushing and burning plants, pesticide manufacture, and phosphorus works. There are some useful comments on the experience of gas washing at several power stations, including Battersea and Bankside. The culprits in the gas works seem to have been mainly horizontal retort installations, while in the process of coke manufacture the quenching of coke causes difficulty. The comments on the pollution arising from blast furnaces, Bessemer converters, and iron foundries will be of interest to many who have such pollution in their own districts.

Another section deals with the problem of spoil banks. During the visit of Mr. Damon to America he was able to discuss the matter with American experts, and a short description of practice in the U.S.A. is given. The Americans use the descriptive term "Gob pile!"

The shorter report by the Chief Inspector for Scotland has the same story to tell but also includes a report on a fell-mongering business and a fish-meal works.

Mr. Damon reminds us that this is the last report he will present to the Minister. All would agree with him that "a spirit of mutual confidence and goodwill between Inspectors and industrialists is essential to progress in the abatement of air pollution." We would like to take this opportunity of paying a tribute to the hard work Mr. Damon has carried on for so many years, and while wishing him a most happy retirement, hoping that we may gain yet more help from his ripe experience.

British Electricity Authority Report

This seventh report is well up to the standard of presentation reached by its predecessors, and the contents are of at least equal interest.

The general picture is again one of progress, the implementation of new methods, and the extension of research. Nearly 74,000 million units were generated at the Authority's power stations—11·9 per cent more than in the year 1953-54. The number of consumers has increased by 3·8 per cent to nearly 15 million, while sales of electricity increased by 11·8 per cent. Since vesting day, the number of consumers has increased by 27 per cent, and annual sales by 76 per cent.

Some of the shortages mentioned last year have been partially overtaken, and it has been possible to bring into operation several new, high efficiency power stations, thus reducing the calls on the older, less efficient plant. The average price of electricity during the year was 1·370 pence per unit. This compares favourably with the 1953-54 average of 1·373 pence per unit, and although approximately 30 per cent above the price in 1937-38, it is apparent that the increase in cost is considerably below that for the large majority of products. This is the

result for which one would hope in a large scale industry, consequent upon the introduction of more efficient plant. Yet further economies should result from the work of the operational research teams now being set up in four of the divisions and the Chief Engineers Department.

Four paragraphs are devoted to the question of air pollution. There is an interesting short account of some tests made at the new St. Neots power station, where techniques are being developed to observe the dispersion of chimney fumes, and in particular the effects of land contour, wind force and direction. A more detailed account of these experiments would be widely welcomed. In connection with gas-washing, the Authority reiterate that it is not established that it could be effectively introduced, that there would be heavy initial capital costs, possibly of the order of £250 million pounds, and increased operating costs. This would involve an increase of at least 12 per cent in the generation cost of electricity.

There have been further developments in the matter of staff relations and employment. The number of persons employed in the industry at the end of the year was 190,022, an increase of 5,311 compared with 1953-54. The number of employees engaged per thousand kilowatts of output capacity has decreased however, from 2·20 in 1953-54 to 2·07. Welfare activities in general were expanded, and twenty-six schemes for welfare activities at new power stations were dealt with. Courses mainly devoted to human relations, for technical personnel, proved useful.

There is an excellent section on Nuclear Generation and Fuel Supplies, and an interesting photograph of a model of the type of nuclear power station to come into operation in 1960. There are three other photographs, two of modern power stations, and one of the Authority's laboratory.

Successful Action against Excessive Smoke in Mersey

In the first cases of their kind since the war, three Liverpool firms were fined because their vessels emitted excessive smoke on the Mersey. Mr. A. McFarland (Liverpool Stipendiary Magistrate) was told that last June a smoke pall from the river made local flying impossible from Liverpool Airport and Mr. W. H. Wattleworth (Chief Sanitary Inspector) went up in a plane to investigate.

Mr. A. J. Stocks (prosecuting) said: " It is the Corporation's view that it is very little use going ahead merely establishing a smokeless zone on the land unless this other atmospheric pollution, which comes to a large extent from vessels in the river, is also stopped." The summonses were issued under the Liverpool Corporation Acts of 1921 and 1936, under which it is an offence for certain types of shipping to emit excessive smoke between a line drawn from the Rock lighthouse to Gladstone Dock and Warrington.

The cases were in respect of offences stated to have been committed on September 30 in the Waterloo Dock area. The summonses related to four ships: three tugs and a dredger, two tugs being owned by one of the defendants. The fines were £3 in respect of each vessel.

For the defence it was stated that there were considerable difficulties in obtaining good quality coal, and there were also staff problems. One of the defendants was alleged to have said: " I am always telling the men to take more care when standing at the ready. It is very difficult to avoid making smoke. I remember the days when the ' smoke-jack ' wore a top hat and carried a telescope. He used to summons the chief engineer in those days but it did not cure the smoke."

LUNG CANCER

An Important Communication

A report was published in the *British Medical Journal* of 15th October, 1955, on " Lung Cancer Death Rates among Non-Smokers and Pipe and Cigarette Smokers," by Dr. Percy Stocks and Mr. John M. Campbell. The following is a summary of the communication.

By means of data from the first two years of the study of environmental histories of persons with and without cancer which is being carried out by the Cheshire and North Wales Branch of the British Empire Cancer Campaign, death rates from cancer of the lung and bronchus have been calculated amongst men of different smoking habits living in a rural area of Wales, in a mixed area around Chester and Wrexham, and in Liverpool county borough. The death rates have then been related to measurements of benzpyrene and other substances present in the air at various places within those areas.

The rural death rate increases proportionately to the number of cigarettes smoked per week, and pipe smokers as a group rank with cigarette smokers of about 25 per week. Liverpool rates exceed the rural rates in every smoking category, but the urban/rural ratio falls progressively from about 9 to 1 amongst non-smokers to a small value approaching unity amongst heavy cigarette smokers.

The absolute urban excess is much the same in each smoking group, suggesting that an " urban " factor is added to the effects of smoking. Differences in smoking habits of the population can account for only a small fraction of the contrast in total rates, and it is estimated that about half the Liverpool deaths of men from lung cancer arise from cigarette smoking and that about three-quarters of the remaining half are due to a factor which is only present in the rural area.

The concentration of smoke and of 3:4 benzpyrene, other polycyclic hydrocarbons, and sulphur dioxide in the air rises with increasing urbanization, the benzpyrene figure in Liverpool being 8 to 11 times as great as in the rural localities examined, a ratio which corresponds with the estimated mortality ratio amongst non-smokers living in those areas. When the death rates are compared with the calculated total intake, by different categories of smokers in the areas, of benzpyrene derived from air according to certain assumptions, plus that derived from the number of cigarettes smoked, the degree of correspondence is such as to suggest that benzpyrene might be the one agent involved.

This interim communication is being made because a supposition that benzpyrene plays a dual part, through cigarettes and air pollution, now appears to be tenable, and such a working hypothesis may assist research work in this field whether or not it is finally substantiated.

(*Note:*—3:4 benzpyrene is present in the tarry smoke produced by coal burning inefficiently at relatively low temperatures. Its concentration in urban atmospheres rises considerably during the winter months. The domestic coal fire therefore appears to be largely responsible for its production. See Waller, *Proc. Margate Conf.*, 1950, *N.S.A.S.*).

Higher Chimneys

An article in *Engineering News Record* (New York), discusses the trend towards higher industrial stacks as a means for the more effective dispersion of polluting material. During the last few years there have been a number of chimneys of more than 500 and 600 feet high, and there are now three reinforced concrete chimneys—at the Ohio Valley Electric Corporation at Madison, Ind.—680 feet high, or actually 707 feet above their foundations. The author, Arthur M. Clark, believes that chimneys will be constructed up to 1,000 feet high in the foreseeable future.

The Divisions

The **Scottish Division** of the Society held its annual conference at Ayr on 20th and 21st October. It was a fruitful and enjoyable meeting, with an attendance approaching ninety delegates from all parts of Scotland. The conference opened with a stimulating address by Dr. A. G. Mearns, of the Public Health and Social Medicine department of Glasgow University, on the health aspect of the problem. Mr. John Innes, President of the Division, was in the chair.

Dr. Mearns made a plea for the constant examination of chemical effluvia and by-products. When a chemical substance was absorbed into the body it was broken down, and it was possible for one of the resultant compounds to be more dangerous to health than the original substance. Sometimes the secondary effect was not upon the lungs but on the blood. The pall of smoke overhanging our towns made for debility, gloom and despondency, which were enemies of fitness.

On Friday morning Miss Isobel M. Richmond, Glasgow Education Department Domestic Science Superintendent, read an excellent paper on the domestic aspects of the problem. It was Beaver from the knowledgeable woman's viewpoint. She was followed by a lecture, illustrated with slides, by Mr. C. H. G. Hayward, of Edwards Danks and Company, which dealt clearly and expertly with the industrial, and particularly the steam-raising, problem.

After a luncheon, with the Provost of Ayr as the guest of honour, an address was given by the Director of the Society, Mr. Marsh. He dealt with the present situation, which he said was of such importance that he would not apologize for being serious across the coffee cups. He reviewed the Clean Air Bill and two of the problems that stemmed from it—that of the supply of smokeless fuels, and the extensive campaign of education that must be begun if the new legislation was to succeed. Since pollution cost every citizen £5 to £10 a year, it would be an economic proposition for local authorities to expend up to five shillings per head a year to get rid of it, or £250 for each thousand of their population. Sir Patrick Dollan, Chairman of the Scottish Committee of NIFES made a spirited contribution to the discussion on this paper. He said that one of the most important clauses of the new Bill was that it unified English and Scottish law, a thing long overdue.

On the previous afternoon the delegates were the guests of the Royal Burgh of Ayr on an excursion by coach to Cullzean Castle, a magnificent cliff-top mansion, designed by Robert Adam, and recently restored to its original state of decoration by the Scottish National Trust. The second floor—barred to visitors—is the flat presented to President Eisenhower.

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The **East Midlands Division** met in the Lord Mayor's Rooms, Leicester, on 3rd November, Alderman S. Cooper, the Lord Mayor and Chairman of the Division, presiding. After general business a paper was given by Mr. G. A. Hiller, Chief Sanitary Inspector of Leicester, on the provisions of the Clean Air Bill.

Mr. Hiller said that, while the Bill represented a major advance in legislation dealing with atmospheric pollution, there were a number of criticisms. Some latitude could have been allowed in the provisions for smoke-controlled areas and smokeless zones. He applauded the proviso for giving help to persons to convert their appliances to approved types, but on the other hand it was to be regretted that Crown property should continue to enjoy immunity from the law.

Mr. Hiller also said: " The powers

of local authorities relating to research, publicity, lectures, exhibitions, preparation of films, etc., are extended very considerably and, indeed, will need to be used to the utmost, in order to create a public opinion which is strongly anti-smoke. This is particularly so as regards the domestic smoke problem." He also regretted the omission from the Bill of any reference to a Clean Air Council and the necessity for annual reports on action and progress by local authorities.

Mr. A. H. Wilkinson, Corby, said there was no financial incentive to industry as there was to the householder in the campaign for smoke abatement. He thought more should be spent on research and sanitary inspectors should be sent to America to see how it was done there.

Councillor A. Mead, of Kirkby-in-Ashfield, said that people living in the vicinity of coal pits had industrial and domestic smoke, and spoil banks, too.

Councillor J. Dilworth, of Derby, said that the Bill was a milk and water effort in helping the Smoke Abatement Society and local authorities to clear their towns of air pollution.

There were about 80 members and representatives present at the meeting, and they were entertained to lunch afterwards by the Lord Mayor. The Deputy Chairman expressed the thanks of the meeting to the Lord Mayor for his hospitality.

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A meeting of the **West Midlands Division** was held on the 9th November at the Imperial Hotel, Birmingham, under the Chairmanship of Councillor Eric Gibbons. An address was given by Mr. R. Williams, O.B.E., Chief Sanitary Inspector, Coventry, on the "Creation of a Smoke Controlled Area."

In his opening remarks Mr. Williams said that the new Clean Air Bill, whatever its shortcomings, was an indication of the country's more civilized outlook on the question of atmospheric pollution, and that this change of outlook was largely due to the pioneers of the National Smoke Abatement Society and their persistent and unremitting efforts in the cause of clean air. He suggested, however, that the actual introduction of the Bill was mainly due to the efforts of Mr. Nabarro, and that there would still be a lot of opposition to overcome when the time came for operating the Bill.

In speaking of the exploratory work necessary before introducing a smoke control area, he said that it may not always follow that the first area must be where the smoke emission was densest; on the contrary, it might be good tactics to start in a part which can be made "smokeless" comparatively easily. He also said that it is necessary to estimate the likely degree of opposition to be encountered, and whether it could be met by exclusion of certain premises or persuasion. If the former, then it had to be considered whether such exclusions made the scheme of little value to public health. On winning public approval, Mr. Williams said that the experience of Coventry had been that it is of value to promote a smokeless zone even where the initial scheme may be described as a token zone. Public opinion is conditioned by a small zone to expect its extension.

On the actual preparation for the scheme, he emphasized the need to obtain precise factual information, and the advantage of dividing the area into very small blocks, so that the visiting officers would not miss any buildings. Not only every building but in some cases every room must be visited. A very comprehensive form was essential in order to collate all the information obtained, but on the other hand the interviews themselves should be conducted as informally as possible.

In the ensuing discussion Mr. Farquharson asked the opinion of the speaker concerning the idea of starting smokeless areas from the periphery of a town instead of from the centre, as was more usual. Mr. Williams agreed that this had been tried with success in several cases.

Mr. Norcliffe said he would like to

see more publicity given to the details as they affected the public; the latter should not have to rely on the press.

Mr. Branson, Chairman West Midlands Gas Board, made a plea to local authorities to provide adequate storage space for coke, and gas ignition at all hearths, when building new houses.

Mr. Binder of N.I.F.E.S., moved a vote of thanks to the speaker, which was seconded by Miss Humfries, of the West Midlands Gas Board.

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The **North-Eastern Division** have made arrangements to invite Mr. Alfred Robens, M.P. for Blyth, and Mr. Arthur Blenkinsop M.P. for Newcastle East, to address the Annual Meeting in Newcastle. The date of the meeting has not yet been fixed, but it is expected it will be early in 1956, and we hope to report more fully in our next issue.

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The **Yorkshire Division** held a meeting at Skelton Grange Power Station, Leeds, on 10th October. After the general business meeting Mr. H. E. Vickers, Generation Engineer (Operation) C.E.A., gave a talk on Skelton Grange Station.

Members were particularly interested in details of the ash handling plant and the electrostatic precipitators. The precipitators have a proved efficiency of 98 per cent. In reply to questions Mr. Vickers stated that they were at present burning 20,000 tons of coal per week, the sulphur content of which was 1·5 to 3·5 per cent. The coal mills were fitted with pyrites traps which help to reduce the sulphur discharged to the atmosphere. When the proposed new station was built it would have one chimney, 500 ft. high. There would also be combined mechanical *and* electrostatic precipitators, having an efficiency of 99 per cent.

The Chairman, Mr. J. Law, expressed the thanks of all present, after they had been entertained to lunch by the C.E.A., and conducted round the Power Station by Mr. Vickers and other officials of the Authority.

The A.G.M. of the Division is to be held on Monday, 21st November, in the Civic Hall, Leeds. Arrangements have been made for the meeting to be addressed by Prof. M. W. Thring, of Sheffield University, and we hope to be able to report this in our next issue.

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The Executive Council of the **South East Division** visited the Pimlico District Heating Undertaking on 11th November last. The Mayor (Cllr. P. Stirling, J.P.) welcomed the party, and Sir Ernest Smith replied for the Division.

Mr. Bryan Donkin, the Engineer for the Undertaking, then explained the principal characteristics of the scheme, and concluded with the remark that the scheme had created a sizeable smokeless zone. Ald. Russell gave some details of the economics of the scheme, and said that the higher the cost of coal, the more advantageous the scheme.

After refreshment the party was conducted to the control room, pump room, heat accumulator, calorifiers, and an occupied flat.

Ald. C. H. Smith, O.B.E., Divisional Chairman, thanked the Mayor for his hospitality.

On 21st November the South East Division visited the Shell Co's. Refinery at Shellhaven. The visitors were received by Mr. E. Jones of the Training Department, and Mr. Black of the same department gave a talk on the Company and the Refinery. After questions the party was conducted round the Refinery, and the processing in each unit was explained.

The members were then entertained to lunch by the Company, and Mrs. E. E. Oliver, Chairman of the Public Health Committee of Thurrock U.D.C. welcomed the Society into Thurrock, and was glad to say that the Refinery did not cause any worry in the area about public health. Mr. N. Bastable Chairman of the Divisional Council, thanked the Company for their hospitality.

Some More Meetings

S.I.A. at Scarborough

Sir Hugh Beaver and Mr. Gerald Nabarro, M.P., were among the speakers at the Sanitary Inspectors' Conference at Scarborough in September. Sir Hugh devoted his speech to an examination of the problems that must be faced if clean air, as envisaged by his Committee, is to be secured in the next ten to fifteen years.

" I have no doubt," he said, " that the job can be done. But we shall get nowhere by generalities, or by easy and Micawber-like assumptions that we shall be able to tackle the problems all right when they arise. I myself doubt whether any authority or individual has yet fully envisaged what is really involved in a serious campaign to eliminate smog throughout our country."

R.S.H. in London

Sir Hugh was also one of the principal speakers at a conference held by the Royal Society for Health in London on 17th October. Unless Clean Air was made the national policy of succeeding Governments they would never achieve the Committee's objective, either in quality or time. He feared that " the lengthening shadow of the Chancellor's difficulties might throw all our work in the shade." Sir Hugh was critical of the " escape clauses " of the Bill, and especially that of unsuitable fuel.

The other speaker was Dr. J. A. Scott, Medical Officer of Health, London County Council, whose paper dealt with the Bill and the local authority. He paid a tribute to " the devoted efforts of the National Smoke Abatement Society, which so well deserves in the future the support of every local authority." He thought that the special cases of the Bill were on the whole justifiable. " The Alkali Inspectorate requires a high degree of technical knowledge and it is unlikely that all the sanitary authorities in whose areas there are works to which the Act applies could command the services of officers so equipped."

Course on Air Pollution

An interesting two day course on Air Pollution is being arranged by the College of Technology, Bristol, and will be held at the Redland College, Bristol, on Friday and Saturday, 30th and 31st December. The fee will be one guinea, and a residential fee, to include accommodation and meals, will be £1. Different lectures on the Friday afternoon and evening will deal with the legal aspects, the causes, measurement, and toxicology of air pollution. There will be an introductory address by Sir Hugh Beaver. On the Saturday morning there will be a visit to the works of Messrs. Albright and Wilson, Portishead, and the concluding session during the afternoon will include lectures on methods of prevention and industrial problems. Further details, and registration form can be obtained from the Department of Chemistry and Biology, College of Technology, Unity St., Bristol, 1.

Conference at Bath

A conference on A.P., arranged by the Bristol and District Regional Smoke Abatement Council, was held in the Pump Room on 24th November. It was opened with a welcome by his Worship the Mayor of Bath, Councillor A. N. Dix. Short addresses were given by Professor Parry, M.O.H. for Bristol, on the health aspects of pollution; Mr. E. F. Tew, a chartered architect of Bath, on the effects of pollution, with special reference to buildings of historic interest; and on the present position of the clean air campaign, by Mr. Arnold Marsh, the Society's Director. After a discussion opened by another architect, Mr. J. Ralph Edwards, the film *Guilty Chimneys* was shown.

Correspondence

AIR POLLUTION IN A NATIONAL PARK

The Editor,
" Smokeless Air "

Sir—For some time I have been meaning to draw your attention to the continued desecration by smoke of various parts of the Derbyshire Peak District. No doubt you have already looked into the matter, but I cannot refrain from offering my observations and criticisms on the subject. It gives me great displeasure to see clouds of dense smoke spoiling the enjoyment of this fine open country for many people who come for a " breather " and a change from city atmosphere.

During this summer I have journeyed in various directions from Buxton, and from almost any high vantage point in the whole area, one or more of the three " black spots " may be viewed, be it half a mile or anything up to twelve miles distant. The kilns at Dow Low lime works, near Earl Sterndale, the quarries at Dove Holes, and the cement works near Castleton are the worst offenders, and drifting clouds of smoke may be seen trailing for miles across this " National Park." As the black spots are separated their emission is all the more prominent.

I have seen a column of smoke from the cement works as far away as Friden, between Buxton and Ashbourne, and from Morridge near Leek I have watched black smoke belching up from behind a distant ridge and forming haze as far south as the Manifold valley; the culprit in this case being the Dow Low lime works. I have also witnessed the almost complete obliteration of part of the village of Dove Holes, by heavy lime-dust smoke from the nearby quarry. How anyone can live in this I do not know! Is this to continue?

Before criticizing the proposed road racing circuit on the grounds of spoiled amenity, an investigation should be made by some responsible body of the present day licence being taken by local quarry owners regarding the emission of their waste and fumes. Is there no effective means of smoke abatement suitable for these lime kilns, or are our noses and eyes to suffer these wretched sores on the countryside for years to come?

If suitable opportunities occur, I will record these excessive smoke emissions by photograph, for the use of any person or body which cares to take action.

Yours, etc.,
DAVID A. PILKINGTON.

Buxton.

Flue Gas Washing at Battersea

Dr. R. S. Scorer writes: " In the last issue of *Smokeless Air*, in a note about the effect of gas washing at Battersea Power Station, I wrote that the effluents from Fulham power station do not pollute the immediate neighbourhood. I intended to refer only to visible smoke and gases—the plume from the chimneys in fact. I have made no study of the grit and dust that fall out of the plume close to the chimneys, and am now informed that this is a serious problem."

Oil Agreement

The Hargreaves Group of Companies, fuel distributors, of Leeds, have made an agreement with the Esso Petroleum Co. Ltd., whereby they are appointed as distributors of Esso fuel oils over a wide area of the north of England and north midlands. The group will operate its own road tanker fleet for the supply of fuel oils to both domestic and industrial premises.

The Local Government Chronicle.—We should like to join many others in expressing our congratulations and good wishes for the future to the *Local Government Chronicle*—the oldest municipal weekly—on the occasion of its centenary. A special centenary edition of the paper appeared on 29th October.

ALL ABOUT OUR AIR

Our Astonishing Atmosphere, by J. Gordon Cook, PH.D. (Harrap, pp. 200 and plates, 10s. 6d.) is a popularly written volume in the " Science for Everyman " series. For general reading by the layman, or indeed for the more scientific reader outside his own subject, it can be fully recommended. It gives a fascinating description of many aspects of the atmosphere—from the exploration of the upper air to the strange facts about sound, sonic and supersonic, from the gases that make up the atmosphere to its enormous floating population. There is of course a chapter on the menace of poisoned air, illustrated by two N.S.A.S. photographs. Our only criticism of a well-produced book is its annoyingly erratic title page.

Preventing Diesel Pollution

We have been interested to learn of the specialized Diesel maintenance service that the firm of Leslie Hartridge Ltd., of Buckingham, is organizing. The prevention of exhaust smoke depends on efficient operation, which in turn calls for correctly metered and injected fuel, and it is on this equipment that Hartridge's specialize. They will assist traders in equipping and laying out a modern maintenance workshop, and in London operate a school on diesel service where " Hartridge Station " mechanics can attend for pre-installation and refresher courses. Test cards and technical data, etc., are supplied, and calls by technical advisers can be arranged to assist with problems and give maintenance to the workshop equipment.

Such an organization appears to us to be admirable in its purpose, as it is only by such technical service, aimed at efficient combustion, that the growing problem of diesel smoke and fumes can be overcome. We hope that diesel owners everywhere will sit up and respond.

Most Birmingham Deaths in Smokiest Areas of the City

Referring to the relationship between atmospheric pollution and ill-health, the Medical Officer of Health for Birmingham, Dr. Matthew Burn, says in his annual report: " We have no measurements of air pollution covering the whole city, but one's impression certainly is that central wards where there is the heaviest incidence of deaths, are also the most smoky, and that those wards to the east of the city centre also suffer quite heavy atmospheric pollution. The southern wards certainly appear to have the cleanest atmosphere and there the death toll from bronchitis and pneumonia is lightest.

" It would not be wise to accept this as firm evidence of a relationship between air pollution and deaths from pneumonia and bronchitis. Other factors no doubt are involved, such as mode of life, of which ' social class ' has been taken as an index. The so-called lower social classes are found to be more commonly the victims of these chest diseases, but on the other hand they tend to live in the congested and smoky parts of the city."

Unswept Chimneys?

" Good natured and reasonably intelligent though British public opinion usually is, it occasionally gets a bee in its bonnet and goes galumphing off on some wild goose chase. There have been two cases of this recently, the agitation about monopolies and restrictive practices—as if we didn't all know who the biggest offenders are here—and this fuss in Parliament over smoke emission and smog. Now, seeing that there are about nine million homes of one sort or another in this country, all with their quota of unswept chimneys, it ought to be an easy guess where most of the smoke is coming from."—*The British Clayworker.*

PLANT ENGINEERS DISCUSS AIR POLLUTION

Excerpts from a Paper read to a meeting of the London Section of Incorporated Plant Engineers at the Royal Society of Arts on 4th October by

J. B. M. Mason,

Technical Director, Judd Budd Ltd.

We are approaching a time very rapidly when changing conditions will tend automatically to reduce atmospheric pollution very drastically. We are all conscious that atomic inspired electrical energy although round the corner will be fifteen to twenty years before its contribution can be of real account. Even then we shall be fortunate if the energy from atomic power stations can more than off-set the advancing demands for power which our increasing standard of living and our fight for a fair share of the markets of the world will occasion. No one can forecast with authority how, in those future years, the cost of producing atomic inspired power will compare with that from the orthodox steam station, but other trends, I venture to predict, will tend to restrict the use of coal fired boilers, thus removing one of the chief sources of fine dust pollution.

With continuing full employment it is more than likely that the labour drift from the mines will continue. Even though the increasing use of machinery will reduce the arduous nature of the miner's task, the job will continue to be a most unpleasant one when compared with that of the factory worker. I suggest that the output of coals from British mines will fall and even precipitously so in a few years time and, taking a long term view, coal will be forced to take a new, and probably lasting, position not as the premier source of energy for heat and power but as a still remaining vast store of crude chemical material. The only pleasing side of this drift from the mines is that the heavy atmospheric pollution over the colliery villages due to the inefficient combustion of six tons annually of " home coal " will be reduced.

Turning now to the domestic front, I suggest that television, which is still in its infancy, is turning the focal hub of the domestic circle from the hearth to the set. The flickering fire which once one tended and cherished is now forgotten until one becomes cold, for who wants to poke it and feed it if the play is of interest and, in any case, the flickering light is now a nuisance to uninterrupted vision. Who in the approaching age of automation will want to clean out, start, and feed the domestic fire which is an anachronism of modern life? When adequate supplies of suitable smokeless fuels are available it will be yet another fifteen years out of date. Surely then it is wrong to allow domestic heating by means of solid fuel to figure so largely in clean air and fuel policy.

The daughter of today and the wife of tomorrow will want to have a uniformly heated house, thermostatically controlled, without the work and dust associated with solid fuel, and therefore oil, gas, or electricity seem to jump into the picture of the future. Electricity via the atomic power station has, of course, much to recommend it as the chief contestant, but it appears to me that domestic heating policy should be linked with coal as the supplier of basic chemicals and should, therefore, be in the main by gas. If this could be managed economically, then the emission of sulphur compounds from low level chimneys in congested residential areas would be practically eliminated along with smoke and dust. When all is said and done, we are only concerned with supplying smokeless fuel to the thickly populated areas. The outlying villages and hamlets can continue to burn on their domestic fires highly bituminous coals without really

vitiating the atmosphere.

I suggest that modern coke ovens should be erected at strategic places near to the industrial areas and that gas should be supplied for domestic space heating and the furnace coke to industry, where the plant is more catholic in its taste than the domestic fire. The snags are many but, given a sound fuel policy, by no means insuperable. Suitable coal for carbonization could, I suggest, be made available as the demand for domestic and railway coal shrank, and by selective gleaning from industry.

Capital cost will be great—but so will any domestic policy associated with clean air—and, if it is true that the annual cost of the nation of smoke and grit, etc., is in the region of £250,000,000, the whole would be a sound investment. It could be claimed, too, that, due to increasing requirements of gas in cold weather, such a system could not be balanced. I disagree, for balancing quantities of gas could be used by large industries during periods when the domestic demand is below maximum.

Selected industries would know they could obtain uniform furnace coke of a certain grading and quality and the boiler makers would cater accordingly, for they can design adequate plant to burn anything that is combustible so long as they know, within reasonable limits, what is to be provided. These selected industries would then be consuming a smokeless fuel and emitting about half the quantity of sulphur as they are at present. The rest is a matter of economics and the arranging of suitable rates, and this I leave in the good hands of the accountants!

Oil

I feel certain that my friends in fuel oil will think I am ignoring the potentialities of their great industry—such is not the case. For the heating of commercial buildings and the like, oil has a very significant part to play; but I cannot envisage oil being used extensively for domestic heating in this country and one must remember that, at present, sulphur compounds cannot be removed economically from fuel oil. The absorption of sulphur compounds from coal gas is simple and the technique if applied more extensively could make a worth-while contribution to our requirements of raw sulphur, much of which is imported. Oil in industry will, it is assumed, play the thankless part of being used extensively to help fill the gap caused by the shrinkage of coal output and the real advent of power via atomic energy. The high sulphur content of oil is a problem and if we are to free the atmosphere from corrosive compounds the flue gases from large oil consuming units will have to be treated most fully. Fuel oil, if not properly used, can create dense clouds of smoke and soot, and engineers must see that their oil burning plant is purchased from well-established manufacturers and is afterwards installed, operated, and maintained as advised by the makers. Excellent technical advice and assistance is available from the principal oil suppliers and accredited distributors and should be used most fully. I am happy to be able to refer to the Demonstration Unit as designed at the B.P. Research Station. It is built to demonstrate cause and effect of good and bad operation of oil plant and could be used with good results to instruct operators. Petroleum oil has a much larger rôle to perform in the cleaning up of the U.K. than in its use for steam generation and space heating. I refer in particular to dieselization, for those industries where heat penetration on a time basis is important and where it can be employed to displace more than its thermal equivalent of other fuel.

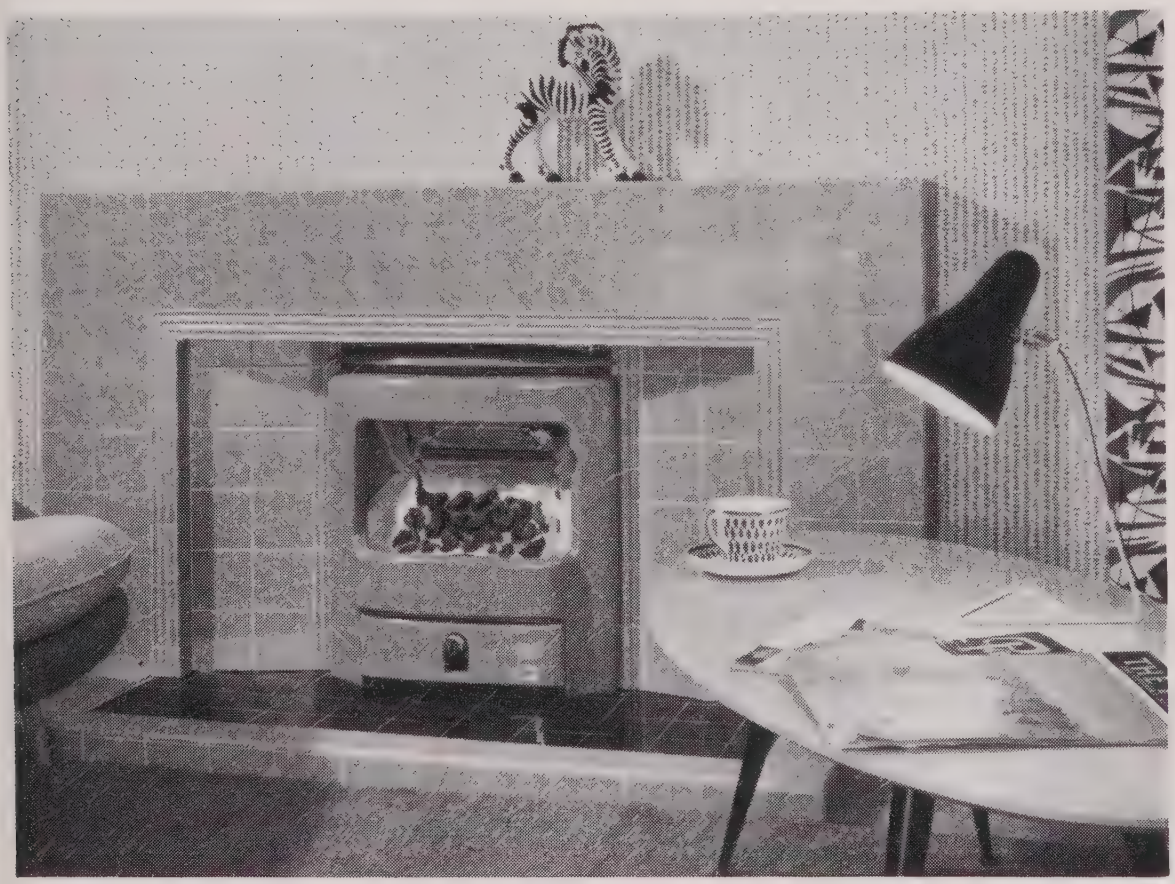
Short-term Domestic requirements

Existing solid fuel burning appliances will have to be supplied and it is conceivable that a proportion of householders will continue to operate at least one open fire in spite of changing domestic way of life. Thus, if grime from existing domestic chimneys is to be eradicated, large tonnages of reactive smokeless fuel will have to be

made available during the period of changeover to gas as the basic domestic heating medium. Apart from increasing quantities of prepared gas works coke which will be made available, a worthwhile contribution could be made via the briquetting of near smokeless fuels with petroleum pitch as the agglomerant. In addition, known low temperature carbonization processes, or others now being developed, requiring graded bituminous coals of low caking indices, could be supplied by cobble briquettes prepared from cleaned smalls.

Even Loads in Industry

Every effort should be made and good advice obtained towards ironing out the heavy peak demands of process load and accumulators should be installed where necessary. I do ask you to make a close study of the steam load cycle of your undertaking and take action to even out the steam demand from the boiler plant. The small boiler units of general industry cannot operate efficiently if they have to cope with peaky loads, and smoke-making can be as heavy at low as during high steam demands. "Save steam and you save fuel in two ways and lessen the smoke and grit nuisance," should be the slogan.



In our Winter 1954 *issue a description was given of the free-standing Parkray No.* 2 *fire, made by Radiation Ltd. Above is the new model, No.* 3, *which is designed to fit into the fireplace opening like a more conventional fire. Its special features are the down-draught control, which improves efficiency when smokeless fuels are used and reduces smoke emission to a considerable extent with bituminous coal, and the convection chamber behind the fireback, with louvres above the fire for the emission of the warmed air. These louvres are removable and can be added to according to the height of the opening.*

THE ANTI-SMOG BOTTLE

Experiments are being carried out this winter on a possible method of combating the sulphur acids in smog. These acids are thought to be the cause of lung irritation which can be serious, especially to sufferers from bronchitis. The method consists of releasing small quantities of ammonia to neutralize acids in the air. These experiments follow investigations by the Atmospheric Pollution Section of the Fuel Research Station.

During the great " killer " smog of 1952 the Smithfield Show was being held. A number of prize cattle died in spite of improvised methods to save them such as breathing masks soaked in whisky. No pigs or sheep died at the Show. The prize cattle were kept scrupulously clean in quarters and under the most hygienic conditions possible, while the pigs and sheep lived in more natural surroundings. It was possible that the ammonia gas, which is an alkali, given off from the pigs' and sheep's litter mixed with the air they breathed with beneficial effect. This seemed to point to the use of ammonia as a possible way of preventing damage to human lungs attributed to acid vapours particularly during smog.

An experiment has started to see if the method has possibilities in fact. The Atmospheric Pollution Section is co-operating with St. Bartholomew's Hospital, where out-patients and some medical staff have been issued with a special ammonia bottle. This is rather like the familiar chlorophyll de-odoriser wick and bottle. It contains a solution of ammonia; during a smog the wick is pulled up and the ammonia gas is thereby released into the atmosphere of the room. The proportion of ammonia must be exact enough to neutralize the acids, so the Fuel Research Station has also developed a special measuring paper to measure the acidity of the atmosphere. If the atmosphere is too acid, the paper turns red. If there is too much ammonia being released, the paper turns blue. The correct balance is shown by the paper turning greenish-yellow.

These ammonia bottles will be used during smogs, if any, this winter. The experiment is in its preliminary stages and it is too early yet to say if it will be successful. *Above all, it does not mean that ammonia should be used indiscriminately about the house during a smog. This may be dangerous, particularly if small children can get their hands on it.*

New Portable Air Cleaner

A Salford firm have recently introduced a portable electrostatic air cleaner. The principle is not new but it is now incorporated in a portable machine for home use. Its purpose is to extract fine particles of dust, pollen, fibres, or smoke from the air in a room. A recent demonstration consisted of enclosing the machine in a large cellophane bag which was then filled with thick pungent smoke from a smoke firework. The machine was then switched on and the smoke disappeared in seconds, sucked by a small electric fan and filtered inside the machine. It was unanimously welcomed as ideal for removing smog particles and other impurities so distressing to sufferers of asthma and bronchitis.

Smog and Lung Cancer

Smog is described as the greatest single cause of lung cancer by Paul Kotin, University of Southern California pathologist. Kotin and a research team have conducted experiments for more than four years with thousands of animals, under a U.S. Public Health Service grant at the U.S.C. Medical School and the Los Angeles County General Hospital. The animals were subjected to artificial smog created by gasoline vapours and fumes from petrol and diesel engines. Kotin said that the study showed the smog " has a prolonged accumulative effect " as a tumour inducer.

RAILWAY SMOKE SUMMONSES DISMISSED

Four summonses taken out by St. Pancras (London) Borough Council against the British Transport Commission, were dismissed by Mr. F. Powell, the magistrate, at Clerkenwell on October 20 last. The summonses, which were taken out in the names of Dr. D. Geffen, Medical Officer of Health for St. Pancras, and Mr. Edward Winchester, Chief Sanitary Inspector, were issued under Section 114 of the Railway Clauses Consolidation Act of 1845 and Section 19 of the Regulation of Railways Act of 1868. In each case they alleged that the B.T.C. used an engine "emitting smoke and not then constructed on the principle of consuming, and so as to consume, its own smoke."

In dismissing the summonses Mr. Powell said that he found as a fact that the engines concerned were constructed on the principle of consuming their own smoke. But none of them was constructed in such a way as to consume every whiff of smoke. According to the evidence that was impossible. It seemed, he said, that the law did not require that all smoke should be consumed. He found that smoke was consumed as far as possible and that there was no default by the Commission or any of its servants.

Earlier, Mr. Powell described as "Gilbertian" a situation in which, if he imposed fines on summonses brought for the public benefit against a nationalized undertaking, the public would have to pay the fine. "The public are prosecuting the public," he added. "It is a ridiculous situation."

Mr. W. S. Holliday (prosecuting) said it might well be that the case was part of the case for a smokeless London.

Mr. Powell: "Is it your case that the B.T.C. use the wrong kind of coal? . . . Is it possible to construct a railway engine today which won't emit smoke?

Mr. Holliday said at times all engines emitted smoke. The point was that it should be as little as possible. In the present case after complaints were made something was done to reduce the amount of smoke. The inference was that previously all was not being done that might have been done to keep the smoke to a minimum.

Mr. A. R. A. Beldam, for the Commission, asked Dr. Geffen if he agreed that it was probable that, while getting the fire ready for an engine to get up steam, there would be a certain amount of smoke emitted.

Dr. Geffen: "I am talking of a condition of smoke which is making the lives of the people in that neighbourhood a veritable hell!"

Mr. Beldam: "I am asking you solely about locomotive engines and smoke. Is this right? You have taken no steps whatever to find out whether it is practicable to raise steam in a locomotive without making smoke?"—"I don't think it is the duty of an M.O.H. to do that."

Mr. Beldam: "You are not in a position to say whether the amount of smoke is reasonably practicable or not?"—"Of course I am in a position to say. It was more than reasonably practicable."

Mr. Beldam described the case as being like "a game of bureaucratic shuttlecock and battledore." In regard to the fourth summons, he said that by the time Mr. Winchester got to the engine he had complained about, a foreman was already "telling off" the driver for making smoke. The Commission had since punished the driver.

Mr. Powell remarked: "I am very glad to hear, and I am sure the public will be glad to hear, that the B.T.C. do take disciplinary steps to ensure regulations are enforced."

Following the dismissal of the summonses the General Purposes Committee of St. Pancras Borough Council are of the opinion that the action was fully justified, and are recommending the Council to take further action whenever it is found necessary.

KNOWN FACTS ABOUT A.P.

H. G. Clinch, one of the best-known and most respected names in the world of smoke prevention, has not been idle since he retired from his post as Chief Sanitary Inspector at West Ham, for he has written for the London and Home Counties Smoke Abatement Advisory Council a report on " Atmospheric Pollution in London and the Home Counties: A Report on Known Facts." It has been published by the Council (Westminster City Council Depot, Monck St., Horseferry Rd., London, S.W.1.) as a 56-page booklet at the reasonable price of 1s.

It is, as would be expected, a most readable and freshly-written report, containing a remarkable amount of information, all of it known, but some less known than the rest. When Mr. Clinch disagrees with anything, as regrettably he does with smokeless zones and prior approval, he speaks his mind frankly, and when he is drawing on his long years of practical experience he is usually saying something that a younger generation of inspectors can read with profit. " Known Facts " suggests something purely and coldly objective, but in this case the commonsense and personality of the author keep on breaking in and make the booklet a live addition to the literature.



Just outside the City of London smokeless zone—smoking chimneys of the Law Courts! A photograph taken from the offices of *Municipal Engineering*, by whose permission it is reproduced

THE CLEAN AIR BILL

Excerpts from the Second Reading

THE Parliamentary Secretary to the Ministry of Housing and Local Government (Mr. W. F. Deedes): I beg to move, That the Bill be now read a second time.

The Bill fulfils an undertaking given by my right hon. Friend the Minister of Housing and Local Government nine months ago. It is based on the recommendations of the Committee, presided over by Sir Hugh Beaver, which reported its conclusions just a year ago. I should like to say straight away, and not for the first time, what an immense debt we owe to Sir Hugh and his colleagues for the work that they did.

We think that the Bill represents a big step forward in combating the scourge of air pollution, the evils of which are by now widely known. It outlines a series of practical steps which we believe will make, within a short term of years, our towns and cities cleaner and healthier places in which to live. Since 80 per cent. of our population are urban, it follows that the Bill bears upon the health of at least threequarters of our people. I hope that much of it will be common ground between us.

The first objective of the Bill is to prohibit the emission of dark smoke from chimneys, railway engines and vessels, and these provisions follow closely the recommendations of the Beaver Committee. We accept that dark smoke is a nuisance, an evil, and generally is quite unnecessary. Given sound equipment and careful operation, bituminous coal can nearly always be burned in industrial furnaces without producing more than a light haze of smoke.

Clause 1, then, insists upon the efficient use of efficient plant. What is to be expected is that there are circumstances in which the emission of dark smoke is unavoidable, and such exceptions are based on technical considerations. When a furnace is first lit, or during soot blowing; there may be short emissions of dark smoke. For these and for breakdowns, for defects which could not have been prevented or because suitable fuel could not be obtained, some allowance must be made. We must face the fact that these provisions will involve improvement and alteration of many industrial plants.

It was on this account that the Beaver Committee recommended a seven-year period of grace in which to show that it had been impracticable to effect the necessary improvements which might be considered a defence by means of certificates issued at intervals of one year or less. That we accept and that is the purpose of Clause 2. I am aware that there has been criticism, and no doubt we shall hear more of it during the debate this afternoon, that these first two Clauses offer too many loopholes. We do not think so. At a later stage we will willingly discuss in detail any proposal designed reasonably to tighten up these Clauses, but in all that we propose we have to be realistic, and I shall have more to say about that later.

The second main objective of the Bill is to see that industrial furnaces installed in the future can be operated, as far as is practicable, without emitting smoke. That is self-explanatory. Clearly, it is right to insist upon proper standards for new installations.

The third main objective—and we are still discussing the industrial sphere—consists of provisions for reducing emissions of grit and dust from furnaces. It is made obligatory for all to use such means as are practicable to minimize the emission of grit and dust from all furnaces, new or existing. The operative word here is "practicable" and hon. Members will find it defined at some length in Clause 28 (1), the interpretation Clause of the Bill.

We have to recognize that effective action is not always practicable. The problem here is not quite the same as that of smoke. Smoke can be prevented, or largely prevented, by efficient combustion arrangements, but effective prevention of grit and dust calls for special plant and that, I think it will be accepted, especially in the case of small works, may present considerable difficulties. We have to ensure that large furnaces to be installed in the future, which are likely to emit large quantities of grit and dust, must be properly equipped. That, broadly, is the

effect of Clause 5. All new furnaces which burn pulverized fuel or large quantities of other solid fuel, will, in future, be equipped with efficient arrestment plant.

These three provisions which I have just summarized covering smoke, grit and dust, deal with industry. The fourth, to which I now turn, is concerned with smoke from other sources, that is to say, domestic and commercial premises. We should not underrate the contribution which must be made in this fourth category if our proposals are to be effective. Nearly half the smoke in the air comes from our domestic chimneys and hon. Members may remember that on this point the Beaver Committee reported:

> "No cure can, therefore, be found for the heavy smoke pollution of our cities and towns unless the domestic chimney is dealt with. In our view there would be little justification for requiring industry and commerce to take all possible measures to prevent smoke, often at considerable cost, if the problem of domestic smoke were not also tackled."

In many ways this is a much more difficult problem than industrial smoke. The bituminous coal can usually be used with little or no smoke in industrial furnaces given efficient methods. In most of the fires used for domestic heating, it cannot be so used.

The prevention of domestic smoke will be a major operation involving radical changes in fuel use, involving problems of supply, large-scale alterations of domestic appliances and, of course, a great degree of public willingness. We propose that this operation should be carried through by the gradual extension of smoke control areas similar to the smokeless zones already established in a number of towns under local authority powers. Clause 8 of this Bill empowers local authorities to establish these areas by means of orders confirmed by the Minister.

I should perhaps stress that this is not a battle for the open hearth. It is not part of our intention to put a sudden end to the open fire which remains, if not the most efficient, certainly the most popular, method of heating living rooms. Sir Hugh Beaver's Committee recognized that this would be a long-term policy and referred to a period of fifteen years before the black areas would be covered, and we recognize that progress will depend very much on the willingness of local authorities and of the public to co-operate.

In order not to take up too much time on this part of my speech, I have de-



Mr. W. F. Deedes

"The Bill represents a big step forward in Combating the scourge of air pollution".

liberately given a summary of the Bill. As hon. Members have had the Bill in their hands perhaps for longer than is usual, I hope that may suffice. Having dealt broadly with the provisions, I should, however, like to touch on several other matters which I know are uppermost in the minds of hon. Members concerned with this subject.

First, of course, is the question of smokeless fuels, to which my right hon. Friend the Minister of Fuel and Power has given a great deal of thought. In the black areas alone fuel consumption of about 19 million tons of house coal will eventually have to be replaced by smokeless fuels, and the course of transition must largely depend, I think it will be accepted, upon developments in the fuel industry. We believe that this objective can be gradually achieved over a period of fifteen years. The Parliamentary Secretary to the Ministry of Fuel and Power will be present during the debate and will gladly intervene on any matter of detail of special concern to any hon. Member. For my part, at this juncture I will not enter into more detail on the question of smokeless fuel.

The hon. Member for Stoke-on-Trent, Central (Dr. Stross) referred to sulphur, and I should like to say a word about that. We recognize that sulphur gases are one of the most harmful forms of pollution, perhaps the most harmful, but the problem of prevention is intractable and cannot be cured, in the present stage of technical knowledge, by legislation. The Beaver Committee recognized that. Its Report did not recommend any legis-

lative measures to deal with the question of sulphur.

The problems are technical and progress must be in the development of a satisfactory method of removing sulphur dioxide from the flue gases of large fuel-burning installations such as power stations, and research into methods of preventing or reducing the release of sulphur when fuel is burned. The Government have accepted the Beaver Committee's recommendations that the most efficient practicable method of removing sulphur should be used in new power stations in or near populated areas in future, and research on aspects of that problem is being pressed forward.

I want to say a word about the administration of these proposals. We recognize as do many hon Members, that the Bill will impose immense and increased responsibilities on the local authorities. For all of them it will be a formidable task, and very much depends on them. That hard-worked band of sanitary inspectors, who already have a great many duties—on top of them such current duties as slum clearance—will have a heavy additional load, and there may be problems of additional staff. I think it is fair to say that these additional responsibilities, which may involve problems of technical staff and the need to find them, are in some measure an answer to those who think we should go further and faster than the Bill proposes.

This additional load on local authorities brings me to another anxiety which has been expressed—namely, the proposal made by the Beaver Committee that the work of the Alkali Inspectorate should take in a wider field of responsibility.

The principle has long been accepted—ever since the original Act at the beginning of the century—that the control of pollution from certain industrial processes should be the responsibility not of local authority officers, but of a central body of highly qualified technical inspectors. I do not think that there has ever been a quarrel over that principle. For that reason a number of chemical and other industrial processes are already registered under the Alkali Acts.

I should stress that an extension in the field of alkali responsibility should not be regarded as diminishing the powers or rights of local authorities. [HON. MEMBERS: " It definitely does."] As we have already seen, they will have sufficient to do on their own account and the second thing is that the intention in extending this field is in no sense to give exemption, but rather to ensure that control is effectively exercised by qualified inspectors familiar with the problems of the industry with which they have to deal.

I want now to refer to the Clean Air Council. The Beaver Committee did not suggest, and we do not think it necessary, that this should be a statutory body. But we do feel that a body such as the Clean Air Council should be set up which the Ministers concerned could consult on ways of effectively implementing our clean air policy. I can, therefore, say that we accept the Committee's recommendations, and in due course my right hon. Friend will announce the Council's composition and terms of reference. That will mean a Clean Air Council about which a number of hon. Members have expressed themselves between the date of the Bill's publication and today.

The Bill will come into operation on the appointed day or days. There can be different days for its different provisions. The Beaver Committee thought that a period of three years from November, 1954, should elapse before the dark smoke provisions were put into force and we agree that that is desirable. Local authorities will, possibly, also profit from the short period of preparation for the tasks which lie ahead. But it seems to us desirable that as far as possible the other provisions of the Bill should come into operation simultaneously which will give them and the Bill far greater impact.

It is, therefore, proposed that all the provisions referring to industrial smoke, grit and dust should come into operation in the early part of 1958. The intervening two years, I need hardly say, will not be treated by anybody as a respite, but as a time for active preparation, and that was the point I made when I referred to future timing. The smoke control area provision need not wait until 1958. In principle, the provisions are the same as those which some local authorities already exercise, but we think it would be unreasonable to hold back the financial assistance which the Bill gives to householders and therefore we propose to fix the appointed day for Clauses 8 to 11 which cover this aspect as soon as practicable after the Bill becomes law.

In some quarters a feeling has been expressed that the Bill is not sufficiently comprehensive and that it does not go far enough. That is always a very easy charge to make. There are very few examples in recent history of where a committee or Royal Commission has reported and had its proposals put into terms of

legislation so quickly after the report has been published. There must be members of a good many Royal Commissions whose tomes are now getting dusty on various people's shelves who would rejoice if they had seen half as much done with the recommendations they made. Of course, it is always possible to say that the Government should have gone further and faster.

But the success of the Bill will not depend only upon what the Government or Parliament now enact. It will depend just as much on our being able to get wholehearted—not just willing—co-operation by industry, trades unions, local authorities, employers, householders, and so on. If we are to get a move on, which is the wish of all hon. Members, we must be sure that the best is not made the enemy of the good.

A prerequisite of wholehearted co-operation is a general acceptance that it is a practical, fair and sensible programme. That is the merit, indeed, I would say the necessity, of a carefully balanced programme, not so fast, I willingly concede, as some hon. Members would like to go, certainly not as slow as others would wish. We believe that, broadly, the Bill strikes the right mean and, accordingly, that is why I recommend it to the House.

Dr. Edith Summerskill (Warrington): I was rather disappointed that the Parliamentary Secretary, who had a great opportunity this afternoon, did not seem to be seized with a sense of urgency. Indeed, his handling of the matter was a little inhuman. This is a most important human problem.

The Parliamentary Secretary must surely appreciate that one provision of the Bill is to try to change the fireplaces of hundreds of thousands of people throughout the country. The hon. Gentleman knows precisely what the British character is like and how traditional we are. I would not admit that the statement which he made about fireplaces, and what he extracted from this Bill, will encourage people to be willing to have their fireplaces changed. There should have been a more human approach, and I do not apologise for saying some of the things that I think the Parliamentary Secretary should have said. Perhaps, the hon. Gentleman is flattering me, and will say that he knew I would say them myself, and, therefore, that he need not do so.

It is curious that the public are not more concerned with this problem, which vitally affects the well-being of people in the industrial areas. While people become incensed by the spectacle of food being handled by dirty hands and served in unhygienic surroundings, they seem to accept the inhalation of dirty air with a fatalistic indifference. I have been thinking about this matter before coming to this debate, and perhaps the explanation is to be found in the fact that eating and drinking call for a deliberate act, and it is possible to reject dirty or unsavoury food. Breathing is generally an involuntary act. Air is invisible, and impurities are only noticed when they are conspicuous.

There has been great exaggeration in some quarters. Smoke pollution does not produce diseases peculiar to itself as does, for instance, polluted water. It must be regarded rather as a contributory factor in diseases which are attributable to other causes. Much of the ill-health for which smoke is probably most directly responsible is in its early stages not recorded, for the symptoms are not classified as a disease.

In view of conditions in Warrington, I want to emphasize this point—and this relates to the very welcome statement of the Parliamentary Secretary that it is intended to establish a Clean Air Council. I wish to make this comment on the subject of disease so as to rouse the public conscience and also to make it clear to the Parliamentary Secretary and his right hon. Friend that if the Clean Air Council is established it must be made effective. It must not become just one more committee.

I refer to bronchitis, because I believe the figures about bronchitis in Warrington have been mentioned in the national Press. Bronchitis can appear in any area, but an individual who is exposed to a smoky atmosphere might well develop it whereas he might be free if he lived in a smokeless atmosphere. The serious effect of smoke in relation to pneumonia is not that it directly causes it or makes it more dangerous in the acute stage, but that it impedes the normal healing process. The incidence of cancer of the lung is undoubtedly higher in areas where the degree of air pollution is greatest.

While we tend to dwell on the effect of air pollution on the physical condition of the population, I should like to say something about the aesthetic considerations and how the Bill relates to them. Factory workers living in a smoke-laden town, denied brightness and colour, deserve our special sympathy, for these conditions affect their whole outlook on life. Not only are they condemned to uncongenial

and dirty work, but they emerge into a world which bears all the ugly marks of their industry. When I describe the conditions in the industrial towns of the North, I am conscious of the fact that the Bill, if it is implemented properly, will change the attitude to life of some of the workers in these places.



Dr. Edith Summerskill

"I should make the punishment fit the crime"

It is astonishing to think that a man can be charged with and convicted for a single physical assault but that, on the other hand, he can assault the olfactory, visual and auditory senses of all his fellow townsmen for the whole of his life and still remain within the law. I should make the punishment fit the crime. I should like to see every guilty man who allows a factory chimney to emit volumes of dark smoke compelled to live within the vicinity of the factory. That would make the Bill effective within a year. What the owner of the factory does today is to have a chimney belching forth filthy smoke while he runs off into nearby pleasant Cheshire and lives there.

While the Bill adopts the principal recommendations of the Beaver Committee, it has been hedged by so many savers and waivers as to render it abortive unless we exercise the greatest vigilance in its administration. It seems to have provided a mesh through which the indifferent or the incompetent producer of smoke can escape. Indeed, listening to the Parliamentary Secretary, it appeared to me almost as though the Government had deliberately framed the Measure so as to let industrialists escape.

One need go no further than Clause 1 (3). This Clause prohibits dark smoke from chimneys, but then gives any factory owner the chance to plead successfully that the fuel used was unsuitable. That makes nonsense of the Bill, complete nonsense. The lowest grade of fuel can be used provided the equipment is efficient and there is a skilled man in attendance. Surely the Parliamentary Secretary and his right hon. Friend must have had advice on the subject. They must have known the simple fact that the lowest grade of fuel could be used, and still the chimney would not emit smoke, provided the equipment was efficient Have not they been told this?

Mr. Gerald Nabarro (Kidderminster): There are many serious shortcomings to the Bill. It is ill-drafted. It is much too leisurely, it has wide escape routes and—I speak as a Tory, as employer and a member of the Federation of British Industries—the hand of the Federation of British Industries is writ large between the lines. I ought to know. I presented a much tougher Bill than this to this House last February and members of the Federation of British Industries tried to dissuade me.

There is a prodigious waste of coal in industry today, as the Minister of Fuel and Power made clear when he launched his campaign 48 hours ago. There is a vast difference between the coal-burning-efficiency standards of the best and of the worst within a single industry. I will not fall into the error of generalizing by saying that all industry is guilty of wasting coal in its factories and boilerhouses, for that is manifestly not so, but I would quote again to the House some of the information derived from the chief scientist of the Ministry of Fuel and Power. For instance, a survey of brick-making showed that, for a comparable output of bricks, the most efficient coal-burning brickyard used one-ninth of the coal used in the most inefficient brickyards, a ratio of 1 to 9. It is that kind of thing which is largely responsible for the emission of dark and black smoke into the atmosphere. All this is covered by the first two Clauses of the Bill, although somewhat inadequately.

I turn to the comments made by the right hon. Lady the Member for Warrington (Dr. Summerskill) about the suitability of fuel burnt in industrial boilerhouses. The lowest grade of coal, even slurry, may be burnt in industrial boilerhouses practically smokelessly, and with only a light haze of smoke emitted but no

dark or black smoke, provided that a series of conditions is complied with. There must be, of course, a chain-grate mechanical stoker of suitable design and replacement of the tens of thousands of boilers that are still hand fired in outdated and obsolescent boilerhouses all over the country. A mechanical stoker is essential. There must be a correct primary and secondary draught to the boiler, and there must be correct lagging of the steam pipes and smoke alarms and recorders. There must be a fully qualified boilerman in charge of the boiler. If these conditions are complied with, then the very lowest grades of coal may be burnt in any industrial boilerhouse almost smokelessly.

May I pass to my principal criticism of the Bill. I have explained, as I see it, the urgency of fuel efficiency in industry and the paramount importance of Clauses 1 and 2. The seven-year dispensation, *in extremis*—I emphasize *in extremis*—in Clause 2 is far too long. I do not wish to make invidious comparisons with my right hon. Friend, but I pondered this point before my Private Member's Measure last Session. It is no use legislating for the elimination of dark smoke unless we can, by the use of mechanical stokers, thermostats and all the rest of the boilerhouse equipment required, meet the sudden demand that this legislation would inspire.

I came to the conclusion that the proper period was three years. I shall move, during the Committee stage of this Bill, when we are dealing with Clause 2, to delete seven years and to substitute three years. It is a matter of great urgency, and I hope that I shall carry with me right hon. and hon. Members on both sides. Why I say that the F.B.I. hand is writ large between the lines of this Bill is because it was members of the F.B.I., representing industrialists, who have been responsible for persuading the Minister to put three years up to seven. They say outside this House that Nabarro is a dizzy idealist. The interesting thing is that I have fired more boilers than most hon. Members in this House; I have operated more boilers than most hon. Members, and I have been responsible for more boilers than most hon. Members. I know how to fire a boiler.

Mr. Ellis Smith (Stoke-on-Trent, South): We have had experts quoted. Will the hon. Gentleman now quote another expert?—what the hon. Member for Kidderminster (Mr. Nabarro) said about the waste of coal at Bournemouth?

Mr. Nabarro: Yes, sir. I was accused on the last occasion of being unduly egotistical in this matter. I would, therefore prefer the hon. Gentleman, or one of his hon. Friends, to quote what I said at Bournemouth, and I am perfectly happy that they should do so. I shall seek to reduce the seven years in Clause 2 to three years.

My second point is with regard to unsuitable fuel. I shall seek the total elimination of Clause 1 (3, *c*). That is the subsection which allows a defence on grounds of unsuitable fuel. There is no unsuitable industrial fuel, provided the boiler house is properly equipped and the boiler man fully trained, and it is for that reason that I say that the sub-section should be eliminated. That criticism refers to Clause 1 (3, *c*) at the head of the page.

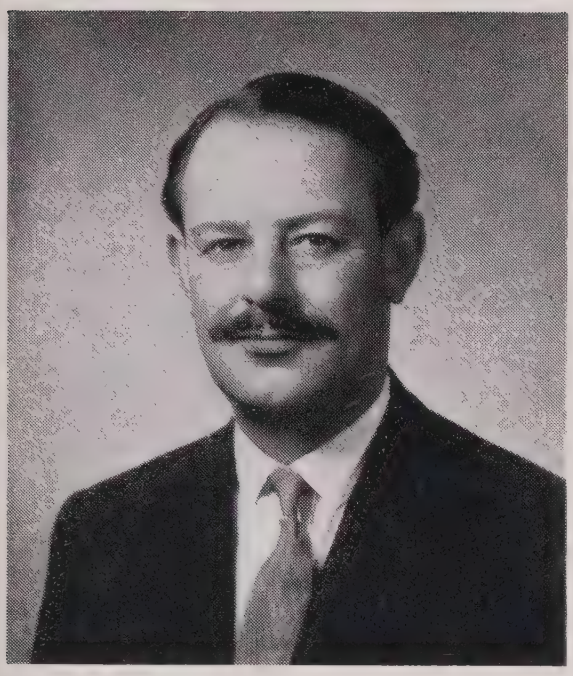
My next criticism is in regard to the duties of the Alkali Inspectorate. I support the general view that that Inspectorate should continue to be responsible for the special processes, involving metallurgical works, carbonization works, power stations and so on, which are referred to in the appropriate section of the Report, except those in the areas of the large local authorities, provided that those authorities can demonstrate to my right hon. Friend the Minister of Housing and Local Government that they have the necessary technical staff and facilities available to supervise such processes.

My next point is that there must be demonstrated clearly a national policy in support of clean air. Fifth, the definition of smoke is quite ridiculous. The definition in page 19 reads:

" ' smoke ' includes soot, ash, grit and gritty particles."

We all know what smoke includes. What we want to know is what smoke is. I have no doubt that my right hon. Friend will say how difficult it is to define it. I know all that. I got seven experts together last January to draft a definition of smoke, and I derived my definition from the established practice of American and Canadian cities where they have demonstrated over a long period of years and their definition can be supported in the courts.

My sixth criticism is that Sir Hugh Beaver was emphatic in requiring that every local authority should submit to the Minister an annual report of the progress being made in implementation of what will be the Clean Air Act. There is no such requirement in the Bill. Seventh, there is no provision for the improved training and ultimate certification



Mr. Gerald Nabarro

"There are many serious shortcomings to the Bill. It is ill-drafted. It is much too leisurely".

of industrial boilermen. Eighth, the tax incentives recommended by Sir Hugh Beaver in respect of industrial fuel economizing plant, the smoke prevention equipment should have been placed in the Finance Bill which has succeeded our autumnal Budget. Someone evidently forgot about it.

My ninth point is that, for Clean Air policy to be effective and thrusting, a Clean Air Council should be provided as part of the legislative instrument and not by administrative action. My tenth criticism is upon something which I think is of great public importance and concern. Why are we abandoning the homely phrase that has secured recognition in all parts of the country in the last few years—" smokeless zone "?

Mr. Lever: Manchester initiated it.

Hon. Members: Salford initiated it.

Mr. Nabarro: Manchester blazed the trail, I agree, but I am not arguing about who started it. I am saying that the transposition of " smokeless zone " to " smoke control area "—a cumbersome and meaningless phrase—is a bad one, and that we should revert to " smokeless zone."

Those are just ten matters which will require amendment in Committee. There are no doubt another 20 or 30, and though my right hon. Friend has rightly said from time to time that this is largely an agreed measure—in that it is not controversial in a party political sense—it is evident that if this Bill is to be truly effective, we shall have to give it a very great number of teeth that it does not at present possess. Much greater urgency must be imparted to the Bill, all escape routes must be closed, and a large number of deficiencies must be remedied.

Mr. R. E. Winterbottom (Sheffield): We have this Clean Air Bill. It is a miserable, hypocritical shadow of the Bill compared with that which was introduced by the hon. Member for Kidderminster. The Minister claims that it implements what he said he would implement. In fact, it almost completely ignores the Beaver Committee recommendations. What is more, by implication it seeks to minimize the air pollution problem that the country is facing.

Who fathered the Bill? I should like to know. It was certainly not the Beaver Committee. I should not like to think that Sir Hugh Beaver would claim that the Bill embraces even a tenth of the Committee's recommendations. Whoever fathered it has produced a stillborn child.

I want to ask a very important question which I hope the Parliamentary Secretary will pass on to the Minister. When will the Government realize that the problem of air pollution is not an amiable sideline to which they can just give lip-service? When will they realize that it is a matter of major social consequence to the health of the community and absolutely vital to the economy of the nation?

I suggest that air pollution by smoke, grit, fumes and filth is now unnecessary, in spite of what the hon. Member for Kidderminster has said. It can be eliminated by the most modern forms of technology and machinery.

Through the Parliamentary Secretary, I say to the Minister, withdraw this puny, miserable Bill. It is not worthy of any British Government. It is not worthy of the people who have to do the dirty jobs of the country, for it will bring no relief whatever to them when finally it is applied to the industries which create nuisances.

I say a final word in respect of the Alkali Acts. As I said in a question to the Parliamentary Secretary, there are nine alkali inspectors. Provision has been made for an extra expenditure of £40,000. How does the Minister hope that such an insufficient staff will be able to conduct the necessary inquiries in order that in any process clean air provisions will be applied to those industries under the Alkali Acts? It is physically impossible.

We would need an alkali inspector in every big town. That is unnecessary. Why should we duplicate the services? The services could be carried out by smoke abatement officers, if they were given powers by means of an effective Clean Air Bill.

At the moment, there is difference between the smoke abatement officers and alkali inspectors as to the range of their duties. Why not canalize the whole of those duties under the smoke abatement officers of the towns? If a town cannot afford the services of a smoke abatement officer, the present law permits the use of these officers on a wider basis than that of the area of a borough council. The retention of this power under the Alkali Inspectorate is wrong and I think that the Beaver Committee was wrong in making such a suggestion and in trying to widen the scope of the scheduled processes. I believe that a more effective method is to remove the idea of remote control and to give to the man who knows the local circumstances and pitfalls the right to deal with the problem on the spot.

Mr. Peter Kirk (Gravesend): Like both the hon. Member for Brightside (Mr. R. E. Winterbottom) and the right hon. Lady the Member for Warrington (Dr. Summerskill), I represent a constituency in the middle of some of the worst polluted air in the country at the mouth of the Thames Estuary. In addition to the normal pollution of smoke and fumes, we have the particular problem of cement dust, which gets into everything in the homes of my constituents and of people in adjoining constituencies. So bad had it become, in fact, that recently the local authorities for that part of North Kent felt that they should come together in an advisory committee to discuss atmospheric pollution in general and, in particular, pollution by cement dust.

As far as I can see, cement dust, in particular, does not figure in the Bill. Of course, there is a very rational reason which the Minister would give to me if I were to put the point to him. He would say that all the powers necessary for dealing with cement dust already exist in the Alkali Act, 1906. To some extent that is true, but it is also fair to say that those powers, certainly in North Kent, do not seem to have been widely effective. Although an immense amount of money has been spent by local cement firms during the last few years in fitting precipitators and so on, the pollution by cement dust in the area is still appalling. It is sad and regrettable that no attempt is made in the Bill to collate the existing legislation relating to cement dust and to make an attempt to clean it up.

Mr. Sydney Irving (Dartford): What disturbs the local authorities as much as this problem is the fact that not only are we not going to be able to deal with the dust but we are not going to be able to deal with the smoke emitted from the chimneys of the cement industry and others scheduled under the Alkali, etc. Works Regulation Act.

This problem is an acute one. There are twenty-three precipitators in north-west Kent. Last year five were out of action at one time. There seems to be grave doubt in the minds of the local authorities whether enough is being done to control this nuisance. Many people in north-west Kent feel that if those industries had been under penalty something would have been done much more quickly. It is very likely that the five precipitators which have gone out of action would not have gone out of action all at once.

Clause 13 will increase the work laid upon the alkali inspectors. I know that some local authorities feel that the work of the inspectors should be transferred to them, or at least that the duties relating to smoke from special processes should remain with them. On the whole, I think that the balance of argument supports the proposal in the Bill, and I could not go as far as my hon. Friend the Member for Kidderminster in suggesting that, in the case of the larger authorities, the work should be transferred to the authorities.

It was suggested from the benches opposite that Manchester was a good example of a local authority to which the powers of the inspectors could be transferred. As a representative of a constituency outside Manchester, I feel that the problem of the Manchester area can be better tackled by the present alkali inspectors than by each local authority having its own inspectors. But is the Minister satisfied that his present inspectors can cope with the additional duties? If not, does he feel certain that he can secure the additional inspectors with the necessary qualifications? We must satisfy ourselves that if we are going to place extra work on the inspectors they can undertake that work and that, if they cannot, we are sure that we can secure new men with the right qualifications.

Mr. Somerville Hastings (Barking): Whether it is a good or bad Bill must

depend on what exactly we mean by "clean" as applied to air. If we mean by " clean " freedom from smoke and grit, then in time I think the Bill will have the effect of producing a cleaner atmosphere. And, from the health point of view, one ought to admit that it may reduce to some extent the incidence of cancer of the lung, because that dread disease—although its cause may be associated with smoking—appears to be more common in smoky and industrial districts. On the other hand, if we mean by " clean air " air free from impurities and substances inimical to health and well-being, I suggest that this is a very poor Bill indeed.

It is unfortunate that, while smoke can be easily seen and recognized, the much more important oxides of sulphur are quite invisible to the eye. In a dry atmosphere they do not hurt us very much. They cause irritation of the eyes, but they do not have a very great effect. In a moist atmosphere, however, in the presence of dust or smoke—and there is dust everywhere in our atmosphere—the sulphur dioxide combines with water to produce sulphuric acid.

In the Press a short time ago, Sir John Cockcroft was reported as saying that in twenty years' time, in 1975, nearly half Britain's electricity would be generated by atomic power, saving 40 million tons of coal a year and consequent pollution of our air by sulphur oxides. I suggest that such a development would result in greater improvement in health than a dozen Bills like the one we are considering today.

Mr. Eric Johnson (Manchester, Blackley): Although we welcome the Bill, all hon. Members on both sides of the House who have the honour to represent the City of Manchester are a little unhappy about some of its aspects. One is that although the Bill provides for smoke-control areas, it does not appear to contain any powers at all in regard to smokeless zones.

There is another point of very great importance to Manchester. Clause 29 (4) empowers the Minister to repeal any provision of any local Act which appears to him to be unnecessary having regard to the provisions of the Bill. Under that provision the Minister could repeal the provisions of the Manchester Corporation Act, 1946, relating to smokeless zones. I hope that the Minister will give the House an assurance that the power will be used only upon application by the local authority concerned.

Mr. C. R. Hobson (Keighley): If the Government are to compel people to install these coal-saving grates and to burn fuel with a poor calorific value, they will get less smoke, but they will get a far more deadly emission of poisons, particularly in the sulphur content. I am amazed at the lip service and, indeed, the praise that is given to these smokeless zones. These smokeless zones in the City of Manchester and elsewhere get something far more deadly than smoke from household fires. I defy anybody to contradict me on this matter or to produce scientific information to the contrary.

This problem must be considered, and do not let us think that just having a smokeless grate will mean we are not poisoning the atmosphere. In fact the pollution is infinitely greater in the smokeless zones than pollution with black smoke. Where there is the burning of coke in large quantities, or the burning of any other form of fuel other than coal, sulphur gas is still emitted.

It is far too easy for the Government to talk in terms of smokeless zones and to suggest that they are laying the foundations of what is required to give Britain a clear atmosphere. The only way in which a smokeless zone can be obtained in any town is by the use of gas or electricity and it would, of course, be politically impossible to compel people to have gas or electric fires instead of coal fires. But that is the only way in which the smokeless zones can be obtained, and we should not assume, merely because we see black smoke, that the atmosphere is being polluted. In fact, in the smokeless zones where there is no black smoke, the atmosphere is far more polluted and dangerous.

We shall have to look at the Bill very carefully and improve it, but the real message I should like to leave with the Government today is that they must press on at all costs in dealing with the question of the emission of carbon monoxide from the exhausts of ordinary motor cars and lorries, and also deal with the problem of sulphur pollution, particularly where large quantities of coal are being consumed.

Mr. Charles Fletcher-Cooke (Darwen): I often wonder if the scientists, who seem to be considering the possibility of making rain nowadays, have not considered the possibility of making artificial wind. Why not blow away by some giant's hand this smoke that hangs over our large cities, such as that which hung over London for four days and killed 1,000 people per day in 1952? Have they

not considered the possibility of producing some kind of artificial wind which would blow it away, which might have saved the lives of those people, and would also have saved the lives of all the cattle which died at Earls Court at that time?

To all the reasons that have been advanced in favour of this Bill, and there have been some very strong ones on the grounds of health, I want to add one, not only on the grounds of health and economics, but on social grounds also, which I think is important. I am sure that the right hon. Lady the Member for Warrington will agree with me when I say that one of the difficulties that we have in Lancashire in attracting new industries to areas which require them is the fact that the appearance of our towns is so very disagreeable.

People who do not know the sterling worth of Lancashire are apt to be put off by the appearance of these towns, and thus people who might otherwise consider coming to settle there and bring new industries to these places feel that they cannot subject their wives and families to the ordeal of this industrial smoke. They think it would not be fair to do so, and one cannot blame them if they have not been brought up to endure it. I feel that on social grounds, and also on the grounds of the proper distribution of industry and labour, it is very important to cure this black smoke and to get rid of the pall of smoke that hangs over our industrial towns, particularly in the North of England.

The Bill is not to apply to the Crown and I should like to know why not. After all, the premises occupied by the Crown are most extensive.

However they are defined, and there may be differences in definition on that, the Crown has very great resources and is far more able to comply with the rather expensive provisions of the Act than many subjects. I do not see why the Crown should not be subject to the Bill in the same way as anyone else, and as it often is in many Acts of Parliament these days. Why has it been given these privileges, because Crown immunity is certainly a privilege in matters like this? Is it simply that it is more convenient that the Civil Service should automatically get immunity, or has the matter really been considered and are there very good reasons why the Crown should be treated in a special way?

Mr. L. M. Lever (Manchester, Ardwick): Speaking as a lawyer, I consider that anyone could defend a person charged with any of the offences committed under the Bill. This Measure not only creates statutory offences but also creates statutory defences.

Mr. E. W. Farey-Jones (Watford): Clean air zones are not necessarily non-poisonous zones; far from it. I am quite sure that some hon. members opposite are as terrified as I am by the fact that while vast and increasing quantities of coal are going to the electricity and gas undertakings, year by year the quality of that fuel is steadily declining. Whatever capital outlay is expended and whatever scientists may do, unless the quality of the fuel fed into the furnace is improved, the position will continue to deteriorate. We owe a debt of gratitude to the hon. Member for Kidderminster (Mr. Nabarro) because it is as a result of his efforts that we have the Bill. He deserves commendation.

Mr. Arthur Moyle (Oldbury and Halesowen): The sanitary inspector has a lot to do at the moment. I hardly think that the chief sanitary inspector of an authority possesses the essential qualifications to understand and deal with smoke abatement and gaseous fumes. I have no desire to see this work taken out of the province of the chief sanitary inspector, but I think there is a strong case for the appointment of a smoke abatement officer with the necessary technical qualifications to deal generally with these public nuisances.

An encouraging fact which emerged from the Beaver Report is that fuel efficiency and smoke abatement are complementary and are good economics. There is a complete identity of interest between employers, smoke abatement and fuel efficiency; the three go together. There is no ethical obligation imposed on an employer by the Bill; it is a question of economics right the way through. The Beaver Report makes that clear.

I cannot understand why the Government are so lackadaisical about fuel efficiency, in view of the provisions in the Finance Act last year enabling fuel equipment to be installed on easy terms, in both loans and interest, and in view of the general conviction shared by all of the importance of making coal work harder and avoiding its waste.

In the circumstances, I should have thought the Government would seriously consider inserting a provision in the Bill fixing an appointed day—giving a few years' grace if they like—and instructing the industrialists of this country and other large coal consumers that unless

they install modern fuel equipment to achieve a reasonable standard of fuel efficiency, they will be guilty of a criminal offence under the provisions of a Bill concerned with smoke abatement and fuel efficiency.

Mr. Ronald Bell (Buckinghamshire South): In my opinion, which I know on previous occasions I have shared with the hon. Member for Barking (Mr. Hastings) and others, it is those fumes and not smoke—the solid particles—which constitute the main danger to health, although of course I think, as I am sure other hon. Members do, that the solid particles must do some damage to the health of those who breathe them. It is the gases, in particular the sulphur gases—sulphur dioxide—which make the great ravages in public health. I think this Bill is very valuable because it introduces steps to get rid of smoke and solid particles.

I think we ought to bear in mind that if we can get rid of smoke we shall have taken an important step towards getting rid of poisonous gases. They may still be emitted and pollute the atmosphere, but, after all, we are concerned with poisonous fumes polluting the atmosphere in its lowest 100 feet. So long as they do not pollute that part of the atmosphere which is against the ground and is breathed by human beings, we need not be so much concerned with the fact that they are polluting the atmosphere generally.

In this country we have only too frequently atmospheric conditions when the layers of air against the earth are regrettably stable. This city is famous for that. The great fogs which hang over us, sometimes for days upon end, mark conditions of that kind. As hon. Members know, they are caused by the cooling of the earth during the night, and the main factor which makes them persist is that the sun's rays cannot penetrate through to warm the earth and allow convection currents to clear the bottom layer away. In my experience, the main reason for that has been that smoke accumulates in the bottom stable level of cold air and prevents the sun's penetration so that, instead of the bottom layer being churned up during the morning, it persists throughout the day until the next night. So we get the dreadful carry-over from night to night, which produces the awful fogs we sometimes experience in London, Manchester and other cities.

If we can get rid of the smoke, with its screening effect on the sunlight—the smoke with its hygroscopic particles which themselves create fog—we shall have taken the first and, in my belief, the most important step that we can take to getting rid also of the pollution of the atmosphere by noxious gases as distinct from smoke pollution. So I think this Bill is a very important Bill. It is only a smoke abatement Bill, but smoke abatement is the easiest problem to deal with and all other problems of atmospheric pollution are mixed up with it.

Sir Leslie Plummer (Deptford): In my constituency people are worried about the permissive Clauses of the Bill. Suppose the surrounding boroughs decide they will not do anything under the Bill. Is Deptford to receive the smog coming up river when the wind is in the South or the South-East? At what stage is the Minister going to step in and say, "You have got to do something about this smog. I insist upon it." There will be some councils, not so progressive as my own, who will find that it is in their interest, or in the interests of some people in their boroughs, not to make the necessary order. We cannot go on playing about with the lives of the people like this. We have to make industry do the things necessary to safeguard the lives of the people and we must therefore insist that statutory powers are both given and used.

Mr. Maurice Orbach (Willesden, East): The Bill pinpoints peculiarities and anachronisms in the Government's actions. We are exporting Welsh steam coal and anthracite, perhaps two of our most effective smokeless fuels, and we are importing coal of distinctly low grades. We are told by experts on both sides of the House that it is possible even when using low-grade fuel, provided that the furnace is efficient and one has a skilled stoker, to reduce the amount of smoke or to prevent the smoke from polluting the atmosphere. The point is, have we the skilled stokers? I know that the National Industrial Fuel Efficiency Service is promoting the training of stokers and that London County Council and other local education authorities run classes in stoker training, but that training is hardly sufficient. We are told that there are 700 trained stokers available. We want not only the training of stokers but a number of other things as well which will guarantee their employment.

The Ministry of Works is perhaps the worst offender in this respect. It does not employ a skilled stoker in the many Government enterprises and establishments which it has under its control. As a result, not only is much coal lost but also

we have the emission through chimneys of the grit, noxious gases and smoke of which we all complain. The Ministry of Works and Government Departments are paying men to stoke their furnaces labourer's rates, plus twopence an hour while employed on steam boilers. If they employ men at these wages, irrespective of any knowledge or experience on a seasonal basis—they sack them in the summer—they cannot be serious about the Bill.

I have some knowledge about this matter because, at the hospitals of which I am chairman, we spend £50,000 a year on coal and coke. We have found from an examination that we made that, in hand firing, by employing skilled stokers we can save one in every four tons of coal. By automatic firing, if we were allowed to have automatic hoppers, we could save between 5 per cent. and 10 per cent. The Government will not allow us to have the hoppers.

The Government say to hospitals that they must not be responsible for any capital expenditure and that where there is a worn-out boiler in a hospital it can be replaced only with a boiler of the same type as the old one. I have had installed for £18,000 a new boiler which is of exactly the same type as the boiler that was installed 53 years ago. If we had been allowed to spend a further £1,400 I could have obtained an automatic hopper that would have saved between 5 per cent. and 10 per cent. of coal and at the same time would have guaranteed that the surrounding air would not be as polluted as it is at present.

Miss Jennie Lee (Cannock): It is a sorry business to think in terms of a great many prosecutions against factories being carried out by local authorities. Give me experts who will come to my own area and give us their judgment about what can be done and what has been done, and we will deal with the factory. We shall not have to go to law against a factory, because if that factory is confronted with informed public opinion which has authoritative knowledge on its side, it will have to bow to that public opinion. I think that would be a much saner way of dealing with this matter than if we have to go through complicated, long legal processes. Obviously, the Government cannot give us a Bill like that.

Mr. Ellis Smith (Stoke-on-Trent, South): I differ fundamentally from the approach of many hon. Members with regard to the alleged incompetence of the Government. I would defend the Government against the charge of incompetence. They are armed with the best legal knowledge that can be tendered to any body of men. They are armed with expert advisers, and with the best draftsmen in the world for framing Bills of this kind. What I do charge the Government with is that they have not framed this Bill in the interests of the people of our country, but have framed it as a result of the desires of the organized employers of this country—the same people who will ruin this country unless this House and the people assert themselves against it.

Mr. Charles Royle (Salford, West): As I said in my interruption, the Chancellor of the Exchequer and the Minister of Housing and Local Government last week sent a very cynical message to local authorities, impressing upon them the necessity for economy. I am wondering whether it will be possible for them to carry out the provisions even of this miserable Bill in the light of that message.

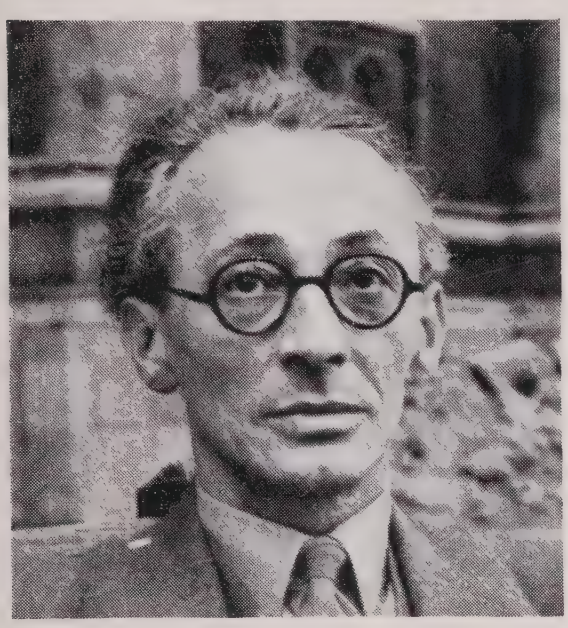
I want to know how a local authority like Salford can be compelled to economize and, at the same time, carry out the terms of the Bill. In July, 1952, my local authority made representations to the right hon. Gentleman's predecessor with regard to the establishment of smokeless zones. Those representations were turned down. Circumstances in Salford could have been considerably improved if the local authority had then been allowed to introduce smokeless zones. The reasons given by the right hon. Gentleman's predecessor were that there was insufficient smokeless fuel and insufficient steel available to alter the grates in houses. Is the Minister quite satisfied that those two difficulties have now been overcome?

Dr. Barnett Stross (Stoke-on-Trent, Central): I know the Minister will accept that a Bill of this type, however good and well-framed it may be—indeed, even when we have finished with it—still represents a marriage between two principles—that which we desire and that which we can practise. It is a marriage between the desirable and the practicable. Such a marriage of principles, like many marriages, sometimes brings with it a little antagonism.

In addition to the incidence of cancer of the lung, bronchitis and emphysema, there is also the aesthetic aspect which I must mention: The corrosion of some of our loveliest historic buildings if they fall within this network of squalor is something we can face no longer. We must

have a remedy for this, and the remedy will have to be against sulphur and sulphuric acid rather than against smoke.

Very strong opinions have been expressed about sulphur, but I thought the evidence given to the Beaver Committee



Dr. Barnett Stross

" It is a marriage between the desirable and the practicable ".

and accepted by most scientists was reasonable, that we do not get sulphuric acid formed unless we have a smoky particle and, in addition to a smoky particle, we must have some water. Then sulphur dioxide and sulphur trioxide gas dissolves into the drop which is corrosive to buildings and deadly to the lungs.

Mr. Hastings: May I ask my hon. Friend whether there is any experimental evidence for the statement he has just made?

Dr. Stross: May I put to my hon. Friend in furtherance of what I have said that, in Regent Street on any day when traffic is heavy, he will find that the sulphur dioxide increases in one hour by one part in 200,000—that is five parts per million. In the smog, the great fog of London, it was only 1.3 parts per million, but it was the smog that killed. It is not Regent Street that kills, even if we get this high density of dry gas.

Mr. Hastings: Ah, dry gas.

Dr. Stross: That is some evidence that in the Beaver Committee Report there was good commonsense when it said that we did not know yet how to get rid of sulphur, but strong protestations were made about the research which ought to be done about it. We can go on to get rid of smoke. There is this sort of synergism, this unholy marriage, between material particles of water vapour and gas, which causes the acid which bites into the lungs and buildings. On that I think the House is agreed, and beyond that I may agree with my hon. Friend. I hope he will now give me a little peace and let me get on.

Then there is the frequent use of the word " practicable " and of such phrases as " practicable steps " and " practicable means." When we study the definition in Clause 28, we discover that the word " practicable " is said to mean

> " . . . reasonably practicable having regard, amongst other things, to cost and other financial consequences. . . ."

There is a very serious principle involved in this. We think it is foolish at this stage in our civilisation, in the environment we have created for ourselves by our industry and our mode of living, to say that costs and financial consequences must limit what is practicable when it is a matter of saving life and health. It really is shortsighted; it is out of date, it is out of time. The cost of avoiding pollution of the air is a rightful charge against the profits of any undertaking in this country. That is a principle we want the Minister to accept. We have proved that profits benefit handsomely when we clean the air, the profits made by the manufacturers themselves, and they are in Stoke-on-Trent the keenest advocates now of clean air.

There are penalties in the Bill. They seem very high for a householder at £10 and extremely low for the industrialists, who might well be the Central Electricity Authority, the Gas Board, the National Coal Board, I.C.I. or some other enormously rich concern. I know that the Minister will not expect us to pass that provision by without a little discussion, and I am sure that we shall be able to have a full exchange of views in Committee.

Those who have flown the flag for us in this matter, organizations like the National Smoke Abatement Society, have put us all in their debt. We all know in the House that legislation is not everything and that we must have education and agitation. The organizations that have helped to educate us and who have agitated for so long have done something for which we are all grateful. If we

succeed in doing almost everything that has been suggested today, I am sure that the Minister will be proud of his child.

The Minister of Housing and Local Government (Mr. Duncan Sandys): Like all so-called agreed Measures, this Bill has been hotly debated today. I only hope that I shall have an easier passage when I introduce the Housing Subsidies Bill shortly.

A lot has been said about loopholes and escape clauses and about the use of the word " practicable." I ask the House to believe me when I say that I do not want, any more than any other hon. Member wants, what I might term, though it is a very mixed metaphor, " watered-down clean air." What we all want is a Measure which will be effective and workable and which will achieve results as quickly as possible. It is in that spirit that we have put forward this Measure. We have taken an immense amount of time and pains in considering the precise form of every Clause. I have spent hours and hours myself in drafting this Bill. We have had numerous consultations with all who may be concerned with this problem.

I would say to hon. Members, however, that it does not serve the purpose which we all have in mind to ask people to do something that is not practicable. By all means, if hon. Members wish, let us look at the definition of that word during the Committee stage, but it is not the slightest use to ask people to do something that is not practicable. All we should do would be to kill the whole policy if we produced a Bill which was so difficult to carry out that in practice the administration would have to allow evasions of various kinds if the whole thing was not to make nonsense.

We have been criticized for not including in the Bill a statement that clean air is a national policy. I take no exception to such criticism, but I should have thought that the fact that a Bill was being passed by Parliament to provide powers and finance for the promotion of the object of clean air was in itself clear, conclusive evidence that Parliament and the nation were anxious and determined to promote clean air as a national policy. Nevertheless, if importance is really attached to the point, I am prepared in Committee to examine the possibility of including some general introductory Clause such as has been suggested, though I do not think it will add anything to the Bill.

A great deal has been said about the provision in Clause 2 for a seven-year period—the right hon. Lady and other hon. Members criticized it—during which existing furnaces may be temporarily exempted from the prohibition on dark smoke. Having listened to the speeches, I think it is generally recognized that some period must be allowed for industry to modify its equipment in cases where existing equipment is not capable of functioning without producing dark smoke. The criticism, as I understood it, was that seven years was too long for this purpose. My hon. Friend the Member for Kidderminster urged that it should be reduced to three years. He said that industrialists had " got at " me and induced me to raise to seven years the three-year period provided in his Bill.

With all respect to my hon. Friend, I would draw his attention to the fact that the proposal originated not in his Bill but in the Beaver Committee Report.

Dr. Stross: In the Beaver Report the period was from the enactment of the Measure and not, as is suggested in the Bill, from the appointed day.

Mr. Sandys: If we can agree on that, I am prepared to make the appointed day for this purpose to be the day after the passing of the Bill. So there would be only a day difference between us. It would take that time to bring in the Order, so we can probably agree on that.

Then there was a good deal of discussion about the defence which is provided for unsuitable fuel; that is to say, it should be a defence in the event of a prosecution to be able to show that suitable fuel was unobtainable. That seems to be eminently reasonable but it has been argued that unsuitable fuel can still be burned without making smoke.

Mr. Hobson: Nonsense.

Mr. Sandys: I am advised that that is not correct. I am not an expert on these matters, but I am advised that even with efficient stoking and the most modern plant, it may not always be possible to avoid the emission of dark smoke, if unsuitable fuel has to be used.

I should like to point out to the House, and it seems to have escaped notice during the debate, that Clause 1 (3) (*c*) applies only if it is proved that dark smoke from the unsuitable fuel could not have been prevented. In other words, the fact that suitable fuel was not available is not by itself a defence. What has to be shown is that suitable fuel was not available and that everything possible was done with the unsuitable fuel to avoid the emission



Mr. Duncan Sandys

"*What we all want is a Measure which will be effective and workable and which will achieve results as quickly as possible*".

of dark smoke. It is very difficult to say whether one ought to impose a penalty on somebody who used the best fuel available and took all possible measures to avoid the emission of dark smoke.

Mr. Nabarro: In the circumstances would my right hon. Friend consider a compromise which I think is ingenious? I did not invent it, technicians invented it and it was embodied in the Private Member's Bill to which he referred; namely, to define the maximum volatile content of the particular fuel used, the effect of which would be very greatly to narrow the avenue of escape as a defence under this provision.

Mr. Sandys: If it is desired slightly to narrow the loophole, I will certainly consider that, but it would be better to raise that point during the Committee stage.

It has been suggested that the smoke-control areas provided for in this Bill will be less effective than the existing smokeless zones which have been established in certain cities, and less effective than the smokeless zones envisaged in the Beaver Report. That is quite incorrect. Under the Bill, a local authority can establish a smoke-control area, in which all smoke of every kind from any premises is completely prohibited. That is made perfectly clear in the Bill.

Anxiety has also been expressed about the proviso to Clause 8 (2), which lays down that it shall be a defence to say that nothing but an authorised fuel was being used. That is a point that worries Manchester, and there was something about it in the *Manchester Guardian* today. I assure the House that it is not the intention of the Government to authorize for this purpose any fuels that are not smokeless.

I have been asked questions about the future of local Acts. We are not contemplating any wholesale repeal of local legislation. However, some local authorities may find it convenient to have their local Acts repealed, and to operate in future under this Bill, which provide financial assistance which is not otherwise available. I can give this assurance. We should not, of course, propose to repeal any local Act except after full consultation with the local authority concerned.

Several hon. Members have asked about the position of the alkali inspectors and there has been a certain amount of difference of opinion on that subject.

I think we must recognize that very few local authorities would be able to take over these functions. They would find it almost impossible to recruit technically qualified staffs. In any case, the Government will have to increase—and probably double, from ten to twenty—the number of alkali inspectors. These inspectors are very rare birds. Whatever hon. Members may say, this will not be at all easy, but it would be very much more difficult if local authorities generally were also competing for the very few available experts.

I should like to say something about cement. Cement works were scheduled under the Alkali, etc., Works Regulation Act, 1935. Since then dust-arresting plant costing about £2 million has been installed in these works, and I am advised that the equipment is now catching about half a million tons of dust a year which would otherwise be discharged into the air. It may interest the House to know that I have been informed today that those responsible for the only cement works in the Thames-side area which is not already equipped with electrostatic precipitators—I am referring to the Bevan's works—have now decided to install this equipment at a cost of about £250,000. I think that news will be welcomed by all hon. Members interested in the subject.

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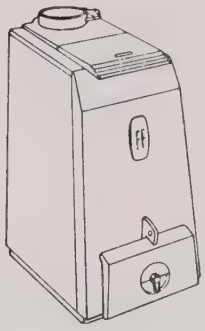
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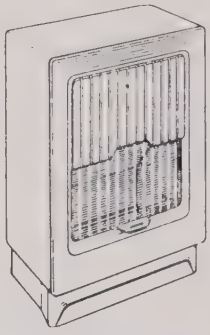
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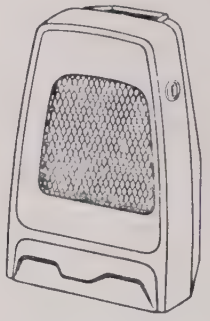
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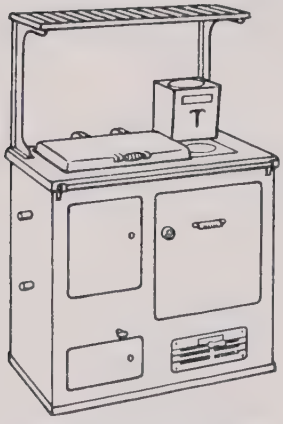
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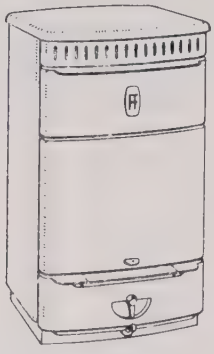
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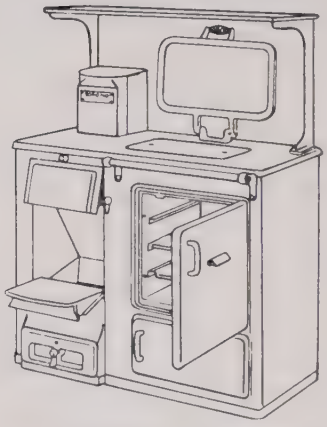
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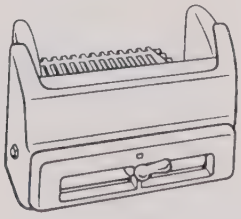
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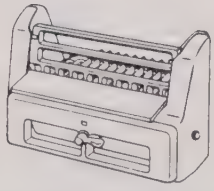
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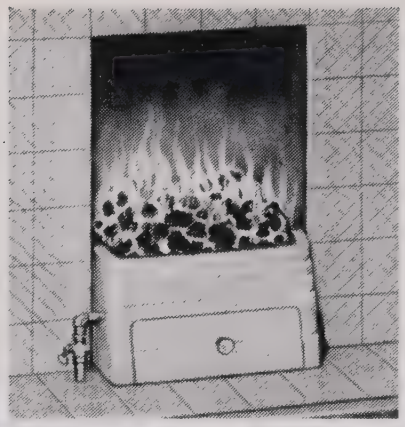
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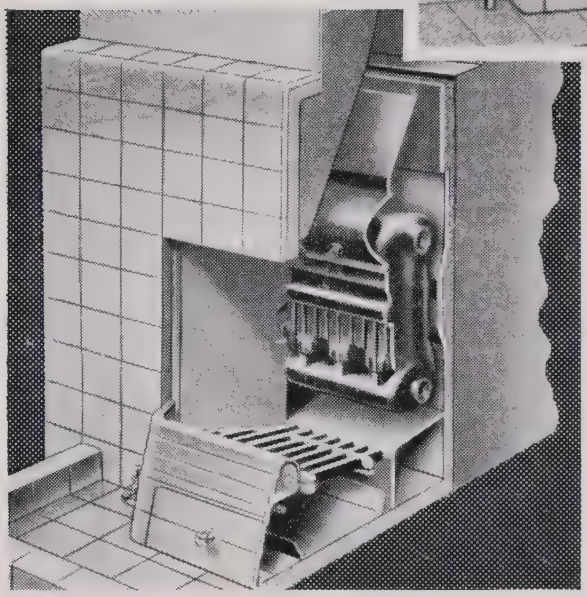
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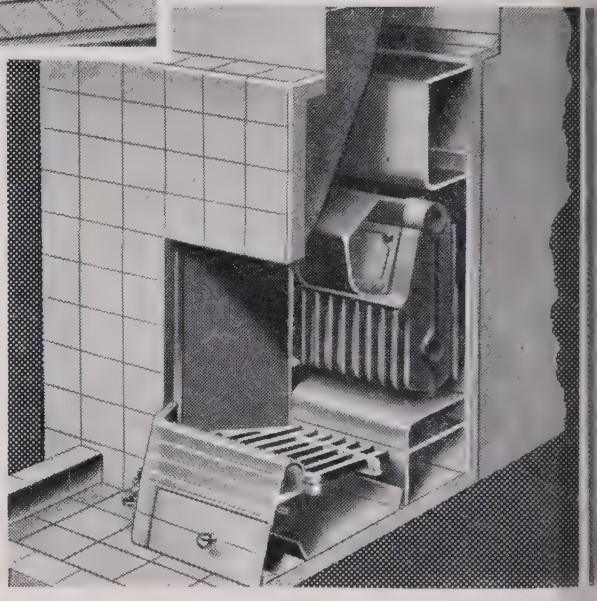


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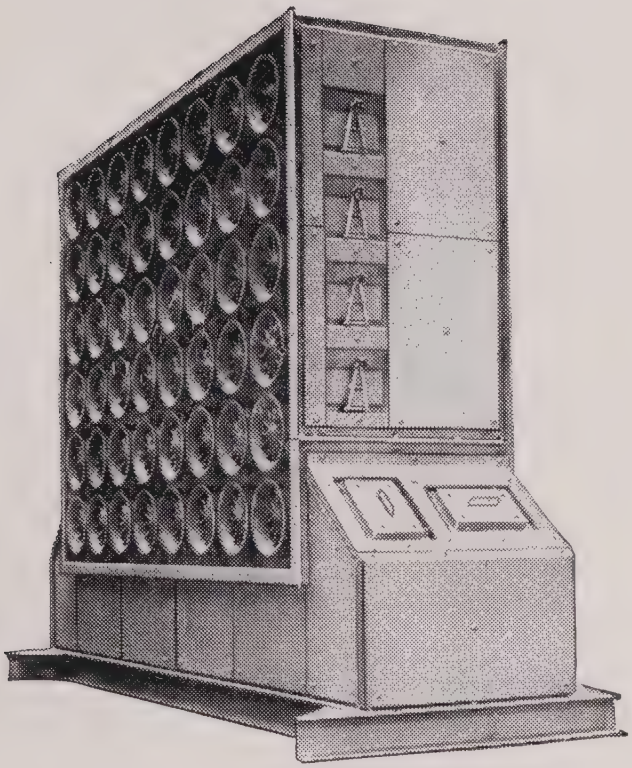
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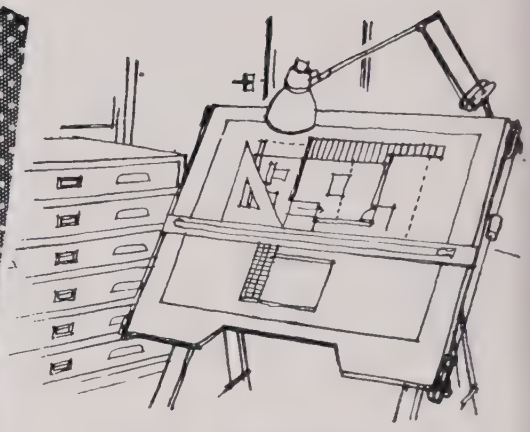
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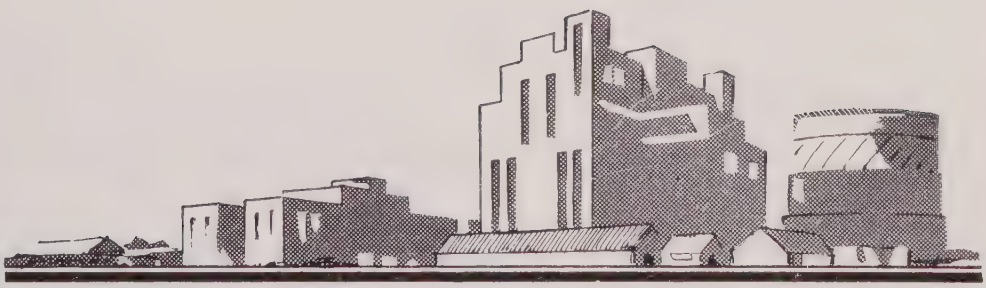
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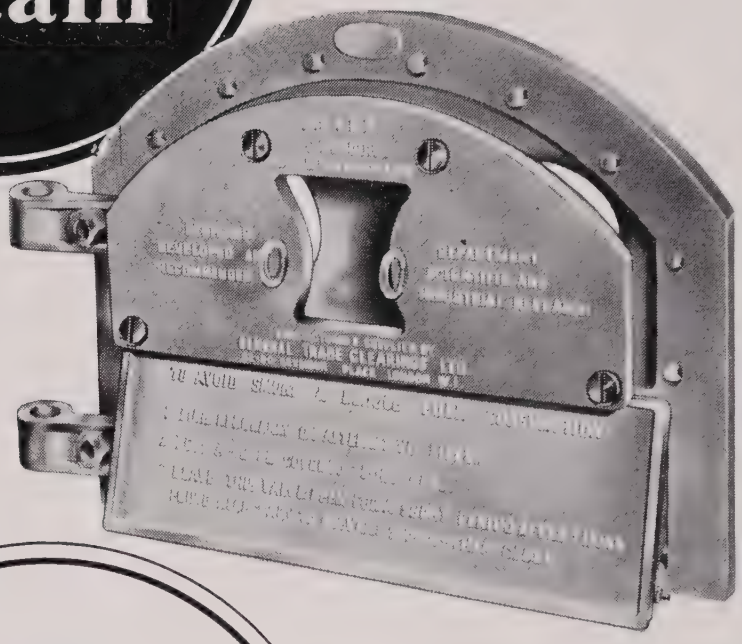
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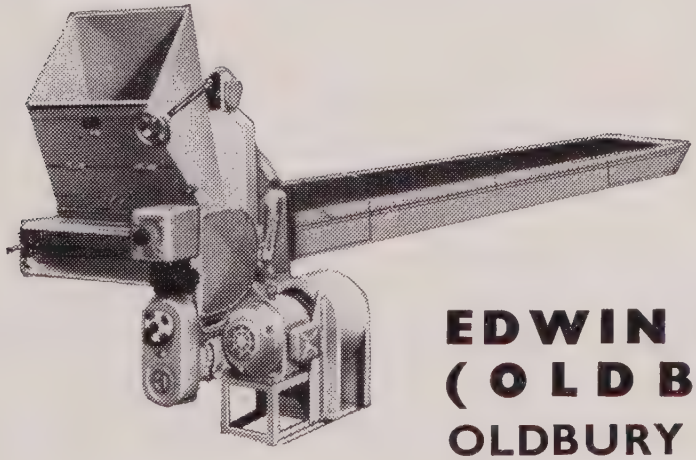
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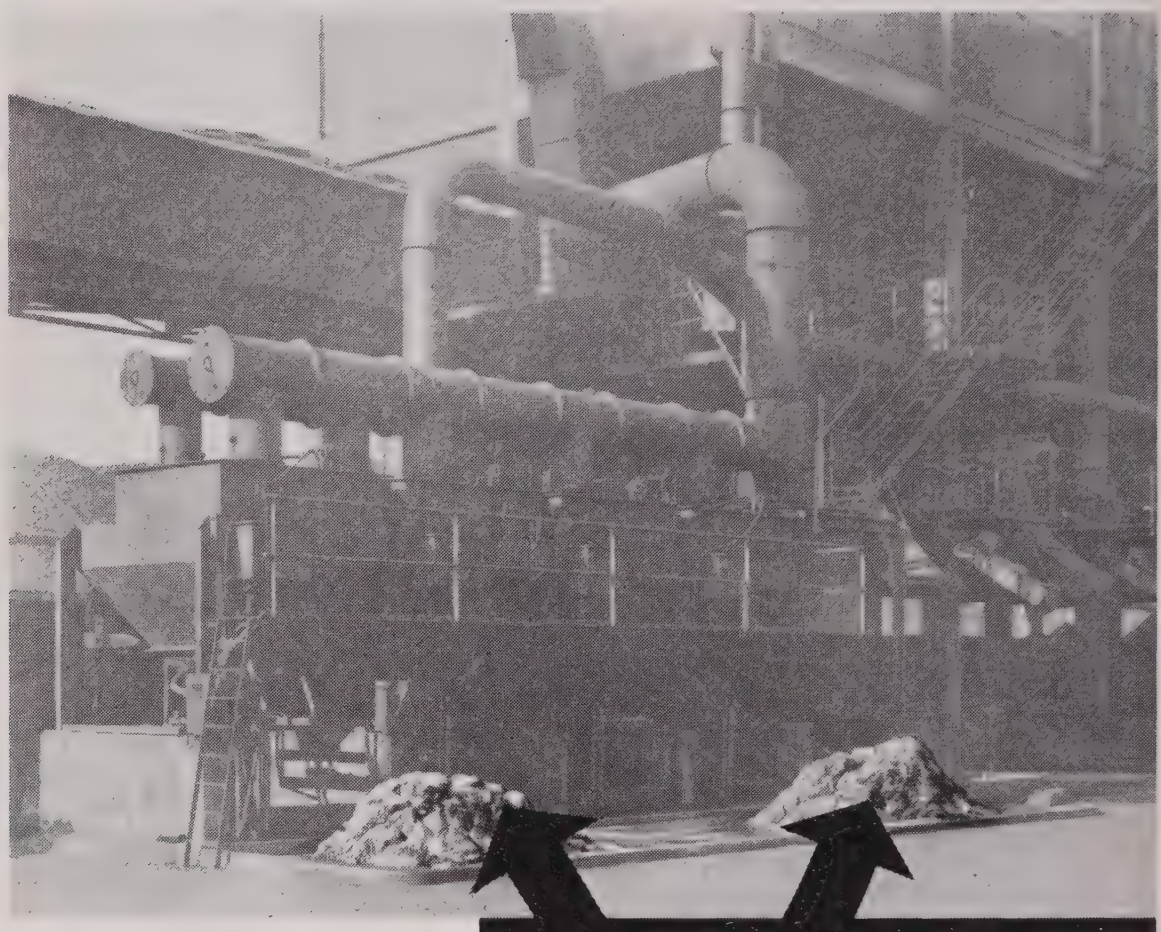
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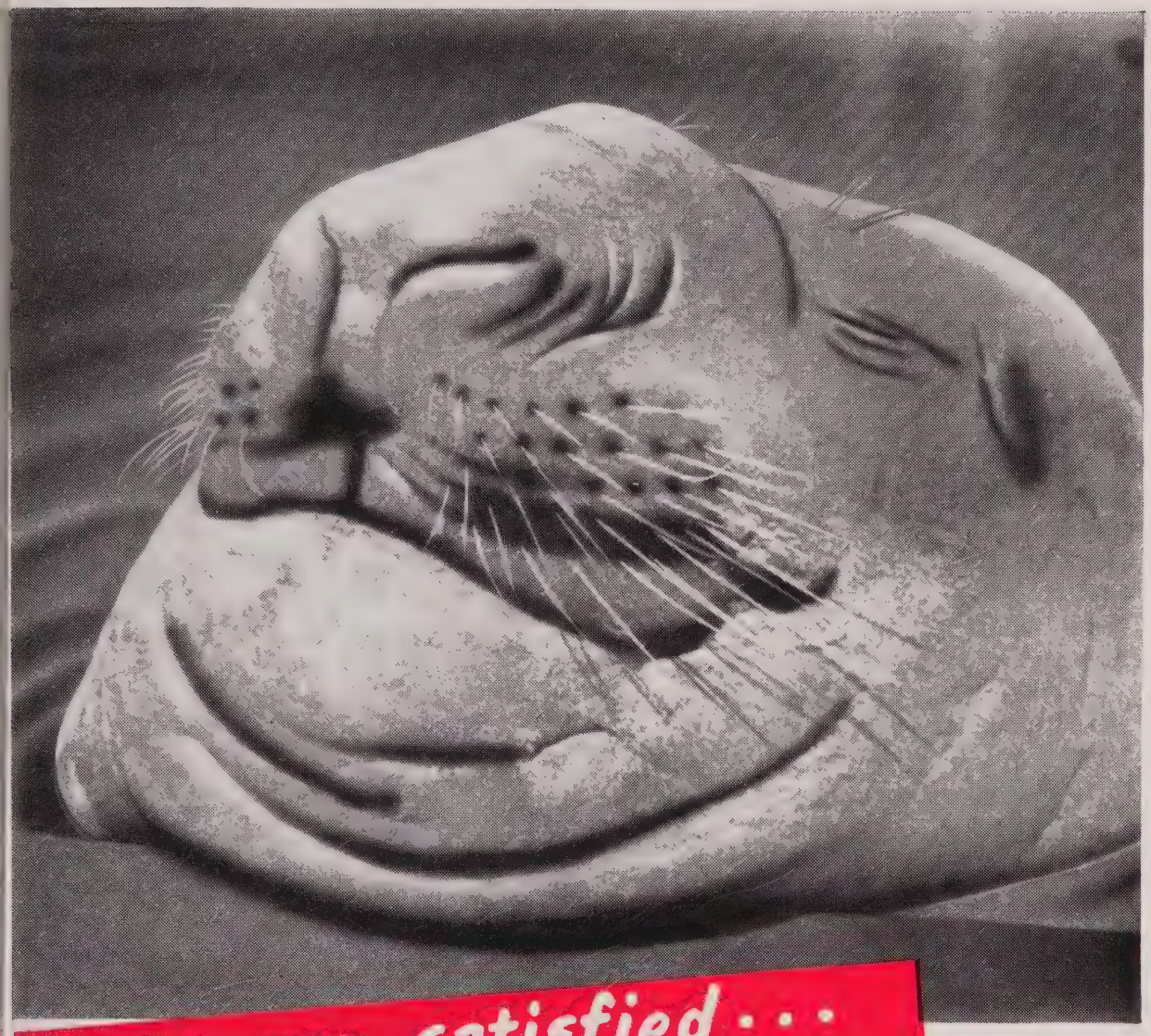
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Official Position SA/1

THE GAS COUNCIL

SMOKELESS AIR

THE SMOKE ABATEMENT JOURNAL



No. 97 SPRING 1956

ONE SHILLING

In this Issue

Clean Air Bill: Amendments Supported
Symposium on Coke
Investigation of Air Pollution Report
Smoke Reduction by Measurement and Control
Dry Fog



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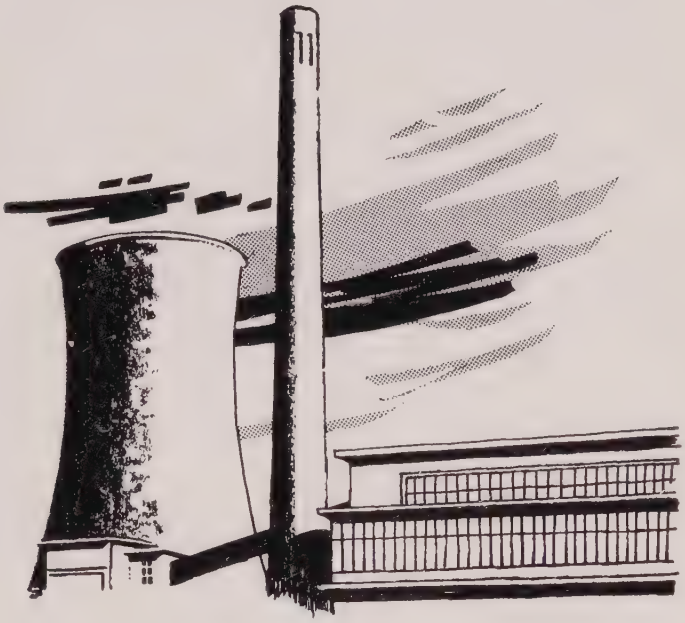
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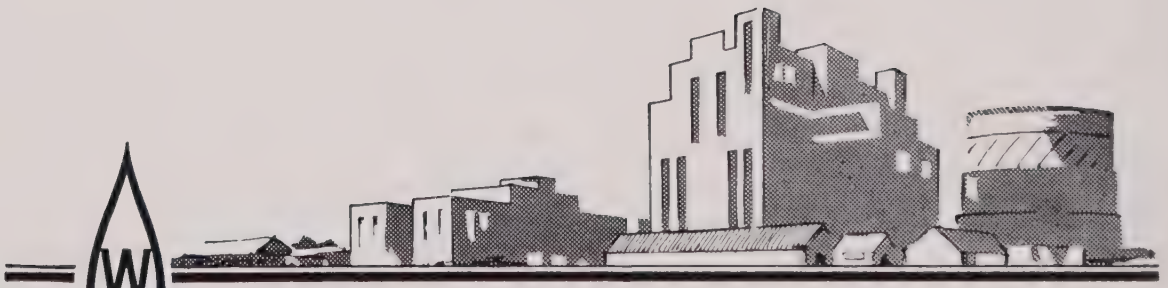
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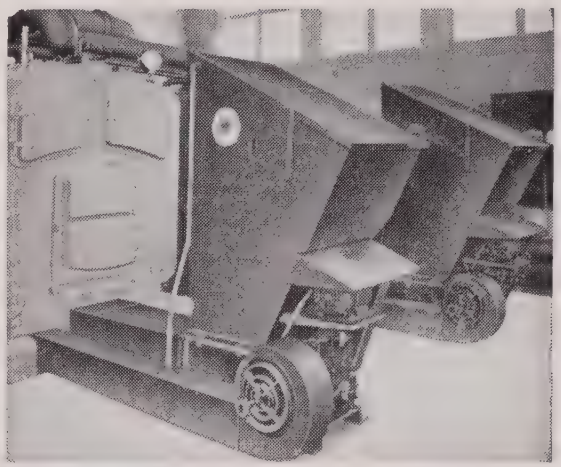
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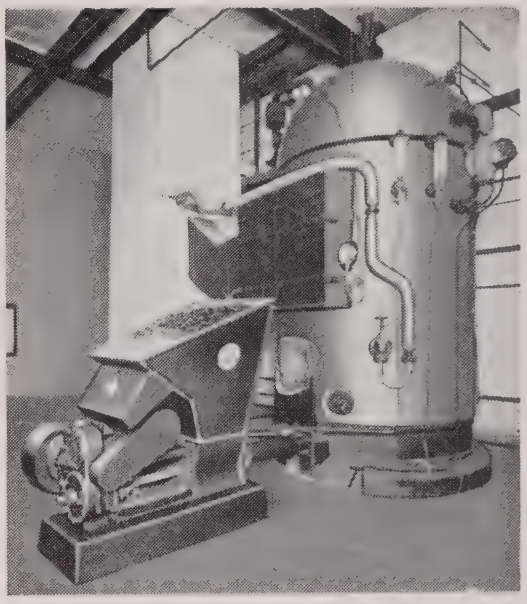
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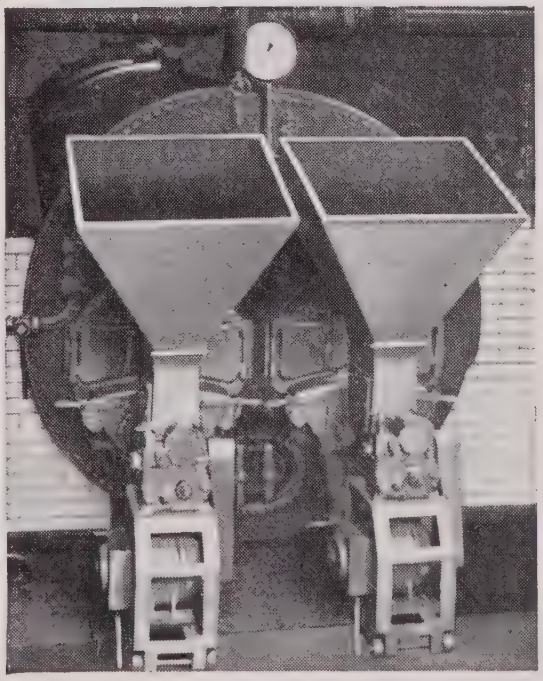
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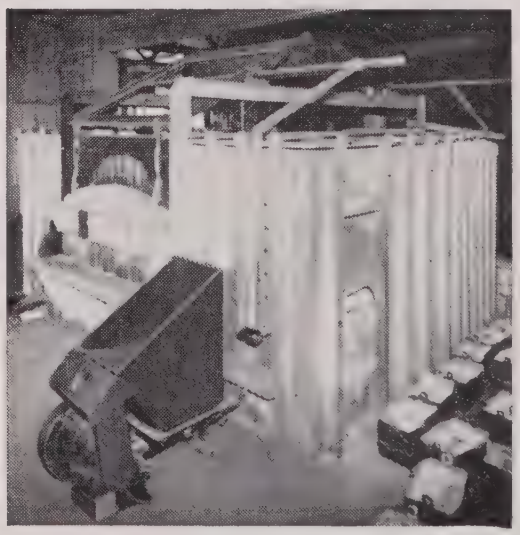
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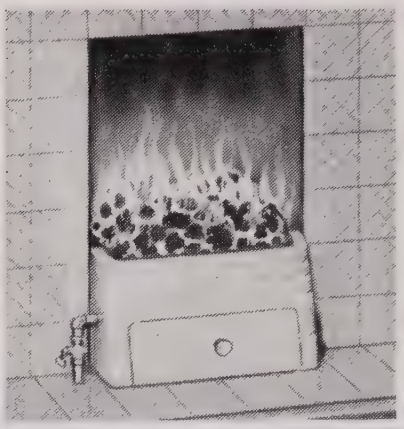
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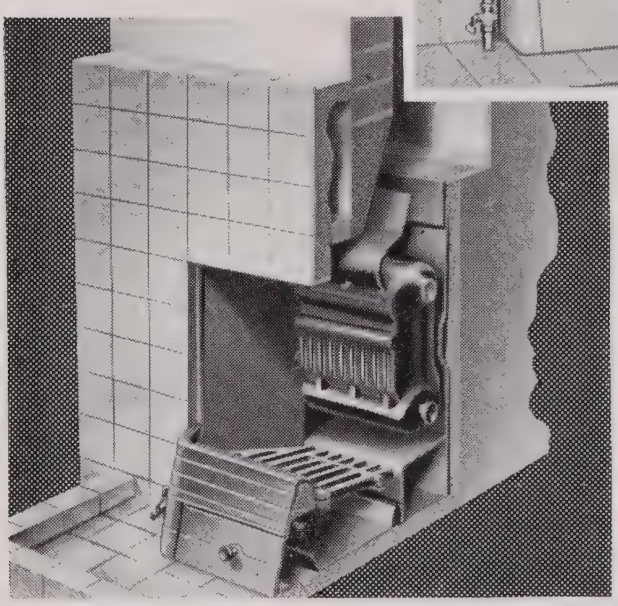
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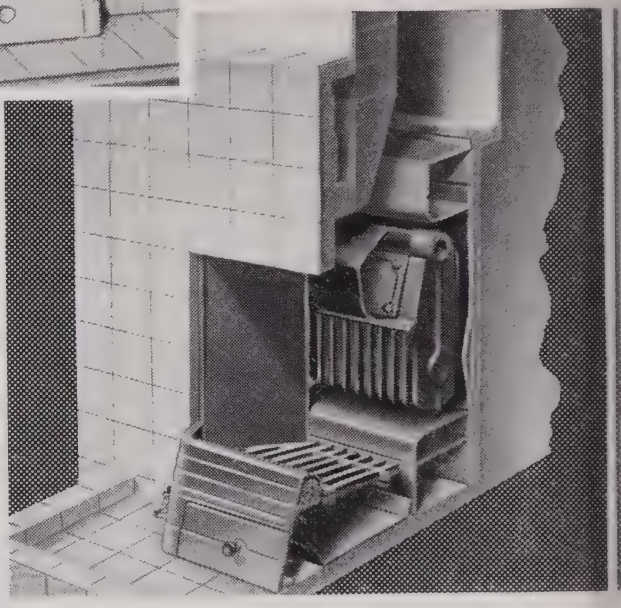
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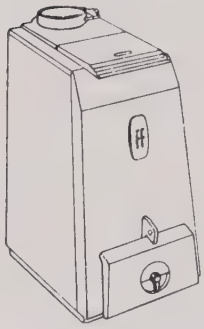
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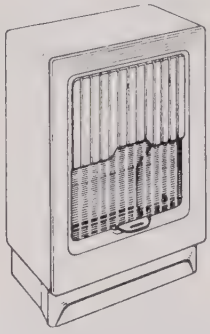
SMOG

the menace to health and wealth

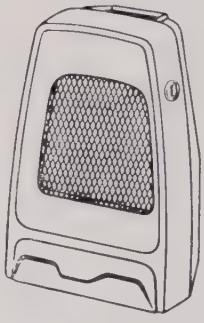
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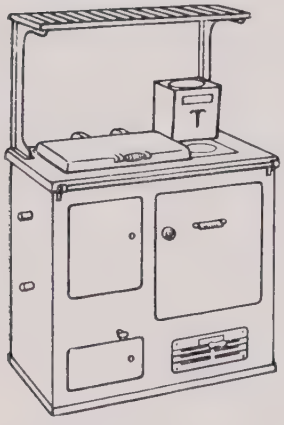
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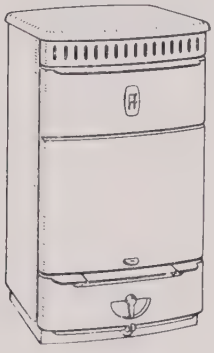
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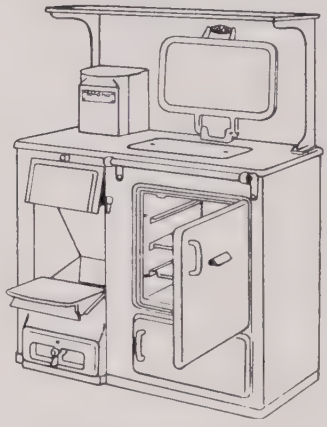
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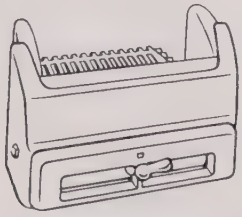
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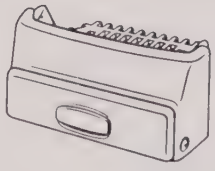
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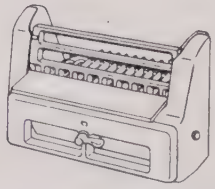
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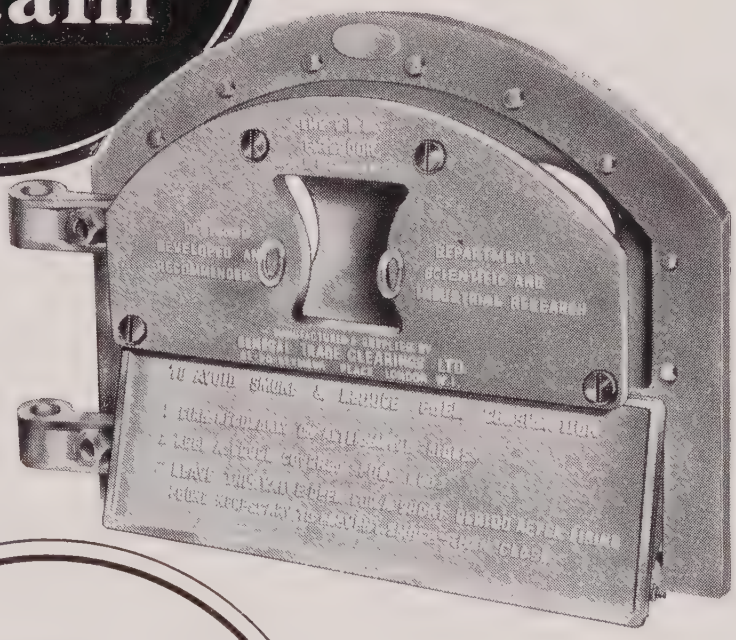


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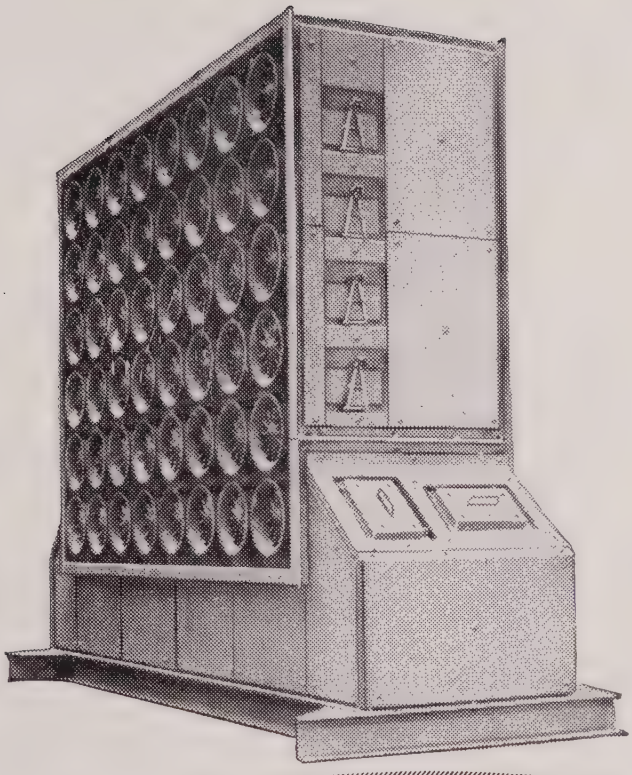
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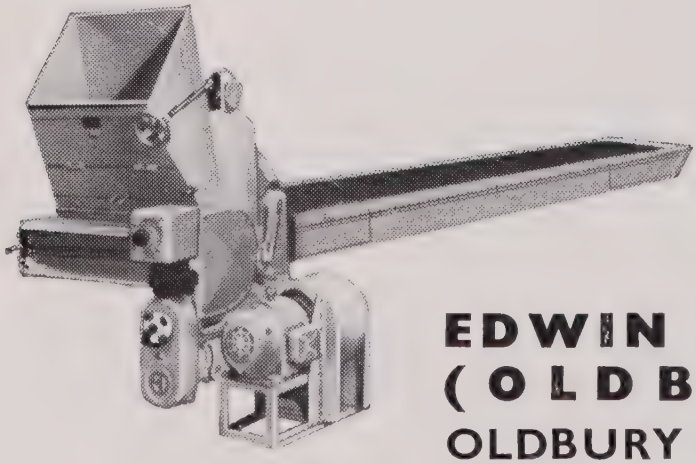
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SMOKELESS AIR

Vol XXVI. No. 97 Spring, 1956

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N.S.A.S. Notices

The **Proceedings of the Bournemouth Conference, 1955** is now ready. It contains all papers and discussions in full, including the Des Vœux Lecture and a verbatim record of the "Any Question on the Clean Air Bill" session by the Rt. Hon. Alfred Robens, M.P., and Gerald Nabarro, M.P. *Price* 12s. 6d. post-free.

N.S.A.S. Year Book, 1956. Contains the Society's annual report for 1955, accounts, subscription list, etc., together with an improved "General Information" section containing material of value to all who are concerned with air pollution and its prevention. Price 1s. Gratis to members and representatives. (*Ready shortly*)

Display Material. A new descriptive list of the Society's exhibits, posters and other display material, including new items, is now available and will be sent on request.

1956 Conference. The Society's next Annual Conference will be held at Southport on Wednesday, Thursday and Friday, 3rd, 4th and 5th October, 1956.



SMOKELESS AIR

Comment

The Bill

THE late publication of this issue is due in part to delay caused by the dispute in the printing trade, and in part to the diversion of editorial attention to the Clean Air Bill. On another page will be found a summary of the main amendments to the Bill desired by the Society, all of which have, in one way and other, had to be elaborated and discussed as the Bill came before the Standing Committee of the House of Commons that is considering it. Most, although not all, of the amendments tabled by Mr. Nabarro have been supported, or suggested, by the Society, and there are others, proposed by members from the Opposition side of the Committee, that we hope will be accepted.

At the time of writing there are 247 amendments and 14 new clauses down on the order paper. The Committee began its deliberations on 9th February, and is continuing to sit on Tuesday and Thursday mornings. The first three sittings were not enough to complete consideration of Clause 1, mainly because of the detailed discussion on one of the most important matters of principle in the whole of the Bill. This arose on amendments seeking to delete the specified defences in cases of dark smoke emission. These defences, and especially that relating to " unsuitable fuel " have been strongly criticized by such bodies as the Association of Municipal Corporations, the Urban District Councils' Association, the Sanitary Inspectors' Association, as well as by the National Smoke Abatement Society, the views of all of which were quoted in the debate. The Government view is that to specify defences is to limit them more severely than the wider and vaguer " best practicable means " defence in the existing law, and that it would be bad law not to specify justifiable defences because if no defence whatsoever were available no extenuating circumstances could be taken into account; or alternatively they might be taken into account by the gradual building up of an undefined and undesirable case law. On the unsuitable fuel defence the Beaver Report has been quoted freely, and especially its statement that " Although the coal is often blamed we are satisfied that coal quality by itself is rarely the cause of excessive smoke." The Government maintain that the defence is justified because the law must take the rare occasion into account.

Among the objections to the defence is the argument that if all the other factors are correct there is no fuel that cannot be burned without the emission of dark smoke, that there is no means for determining when a fuel becomes unsuitable, and that the inclusion of such a defence in an Act will cause it to be used as an almost automatic excuse for dark smoke emission—as indeed it already tends to be. The Minister stated that he was " sincerely desirous of seeing that this Bill shall not, when it emerges as an Act of Parliament, relax any restrictions which already exist." We hope therefore that by the time the Report stage is reached, he will take into account the fact that under the several hundred byelaws in force throughout the country, under section 104 of the Public Health Act, 1936, *there are no defences whatsoever* in respect of black smoke emitted for more than the prescribed period.

The N.C.A.S.?

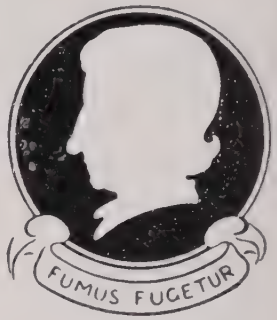
A resolution at the annual general meeting in Bournemouth last year urged that the Executive Council should submit, to the next annual meeting, a resolution to change the name of the Society to a more appropriate one. It was explained that a committee of the Executive Council had in fact been set up to consider the general revision of the Society's constitution, and it was therefore agreed by the meeting that the question of the name should be included in these deliberations.

There have been suggestions from members for a number of years, off and on, that the Society should bring its name up to date—" smoke," it has been argued, is too limited, and " abatement " too weak, despite the traditional value of the familiar phrase, smoke abatement. There always seemed, however, to be a lack of agreement on alternatives, and it is only recently that views appear to have crystallized, for obvious reasons, in favour of " National Clean Air Society," and this is the suggestion being put by the sub-committee to the Executive Council.

That a change of name does at times become necessary and can be carried out with advantage has recently been shown by the Royal Society for Health, which was formerly the Royal Sanitary Institute. Even closer to our own case it has to be reported that the Bristol and District Regional Smoke Abatement Committee has now become the Bristol and West Clean Air Committee.

The use of " Clean Air " would be no new departure for the Society, for the first issue of this journal, in 1929, bore that title. It had to be changed because it was learned that it was a title already in use for the bulletin of an anti-tobacco society. This early reference to the possibility of a change of name in October next is made to enable members to give the matter some thought and an opportunity to express their views. The adoption of National Clean Air Society would of course mean that the Society was no nearer to acquiring a neat set of pronounceable initials in the modern style. Perhaps that is just as well.

Tribute to John Evelyn



Much has been written during the past few weeks about John Evelyn, who died exactly 250 years ago. A new and complete edition of his famous diary has just been published (at 15 guineas) and a book about him and his family circle has also recently appeared. Evelyn has many claims for our continued interest in him. The diary may be less personal and less intriguing than that of his contemporary Samuel Pepys, but it covers a longer period and gives us a much wider picture of the events and affairs of his time, as they were observed and noted down by a man of uncommon sensitivity and possessing a full share of that growing curiosity into the natural world and its phenomena that marked the 17th and 18th centuries and laid the foundations of the modern age of science. In addition to his interest in gardens and trees, and a score of other things, it has to be remembered that Evelyn was for a time the secretary of the young Royal Society, that he twice declined the Presidency, and that because of his numerous offices and commissions for the Government he can be regarded as a distinguished kind of Civil Servant as well as one of the new scientific inquirers.

It was this combination of qualities that among other things led Evelyn to become so keenly aware of the smoke of London and its evil consequences, and gave him the ability and eloquence to describe and analyse the problem in his incomparable " Fumifugium." If he were able to return from the

Elysian fields—which in his hands would no doubt have become a fragrant garden—to his ancient and noble city of London, to find it still full of the stink and darkness he had deplored, he would, we are sure, be pleased that his profile had been adopted as their emblem by those who, 250 years later, were continuing to plead for "the melioration of the aer."

Whitehall Smoke

Bernard Shaw once said, with perhaps a touch of his characteristic exaggeration, that the chimneys of the Government offices in Whitehall created more smoke than the whole of Edinburgh. Since the Society's offices were moved to the corner of Parliament Square we have been unable to avoid noticing how many smoking chimneys there still are, not in Whitehall itself so much as in Parliament Street. In fact, from the far end of Whitehall, Parliament Street in the early morning is often shrouded in its own smoke pall. One has noticed in particular the smoking chimneys of the Ministry of Health and the Home Office, of all places, where open coal fires are obviously retained in at least some of the rooms. It was therefore gratifying to hear that the Minister of Housing and Local Government, Mr. Duncan Sandys, in opening the Solid Smokeless Fuels Federation exhibition at Charing Cross, had declared that, so keenly did he feel about the need for clean air that in his own office he was burning only smokeless fuel. Could not the Minister persuade his colleagues to do likewise? We are aware that some two years ago, on being questioned about these open coal fires the then Minister of Works said that they were suitable for bituminous coal only and that modernization of the heating system would bring them to an end by 1957. Surely, however, the Government could have made temporary arrangements, even at a little cost, to demonstrate its own full acceptance of the clean air programme and of the purpose behind its own Bill?

Going Grey?

Some new, hitherto unsuspected aspect of the harmful effects of polluted air seems always to be cropping up, although in many cases no more is heard about it. We were particularly intrigued a short time ago by a brief report of an American medical lecturer who maintains that smoke brings about a deficiency in airborne iodine. This, he declares, causes hypothyroidism, which results in prematurely grey hair, obesity, visual troubles and so forth, and contributes to the spread of chronic fatigue. For different reasons—principally the loss of natural light due to the smoke pall—one might agree about the contribution to chronic fatigue, but until more evidence is available it would not be advisable to blame smoke for any of the other deficiencies or disorders that may have been noted among one's acquaintances. Whether working for the abatement of smoke tends to promote premature greyness is of course quite a different question.

Southport in October

As we go to press a preliminary note may be given of the principal arrangements being made for the Society's conference opening on 3rd October at Southport. We are pleased to announce that Mr. Enoch Powell, M.P., Parliamentary Secretary to the Minister of Housing and Local Government, who has been intimately concerned with the Clean Air Bill in Committee, has accepted an invitation to attend and to speak to the conference on what it is hoped will by then be the Clean Air Act. The Des Vœux Memorial Lecture will be by Sir Hugh Beaver, whose subject will be the next chapter in the campaign for clean air. One session will be devoted to discussion of "Local Authorities and the Clean Air Act," another to a series of Progress Reports, mainly on health and the provision of smokeless fuels, and a third on "The Housewife and Clean Air." More particulars will be given in the next issue.

The Investigation of Air Pollution

THE NEW REPORT

It is excellent to have the records of the Investigation brought up-to-date by the publication of its 27th Report, which covers the ten years ended 31st March, 1954. (Department of Scientific and Industrial Research: The Investigation of Atmospheric Pollution, 27th Report, H.M.S.O., 7s. 6d., pp. 207).

Up to 1939 the reports were published annually. Then came the war and after that a remarkable rise in the number of co-operating bodies and instruments in use, and it was not until 1949 that it was possible to publish the 26th Report, covering the five years 1939-44. The Fuel Research Station, which co-ordinates and supervises the Investigation, is to be congratulated on having caught up with the back-log by bringing the present report as up-to-date as any record of this nature can be. There is a vast amount of detail in the volume, which in its turn is derived from $1\frac{1}{2}$ million individual observations. The editors and compilers must have breathed a considerable sigh of relief when this task was completed.

In pre-war days this journal reviewed the annual reports as they were published, and we were able to include a table listing the stations making observations, together with their annual deposit figures. This is now quite impracticable, for the number of stations, and the observations they are making, has become far too large. During the ten years under review the number of co-operating bodies making measurements has increased from about 40 to nearly 200, and the total number of instruments used from under 200 to over 1,400. The greatest increases have been in the deposit gauges and monthly (lead peroxide) instruments for the measurement of sulphur dioxide, the number in each case having increased from 100 or less to more than 600, mainly since 1948. There are, however, still only about 100 smoke filters and 50 daily sulphur dioxide instruments.

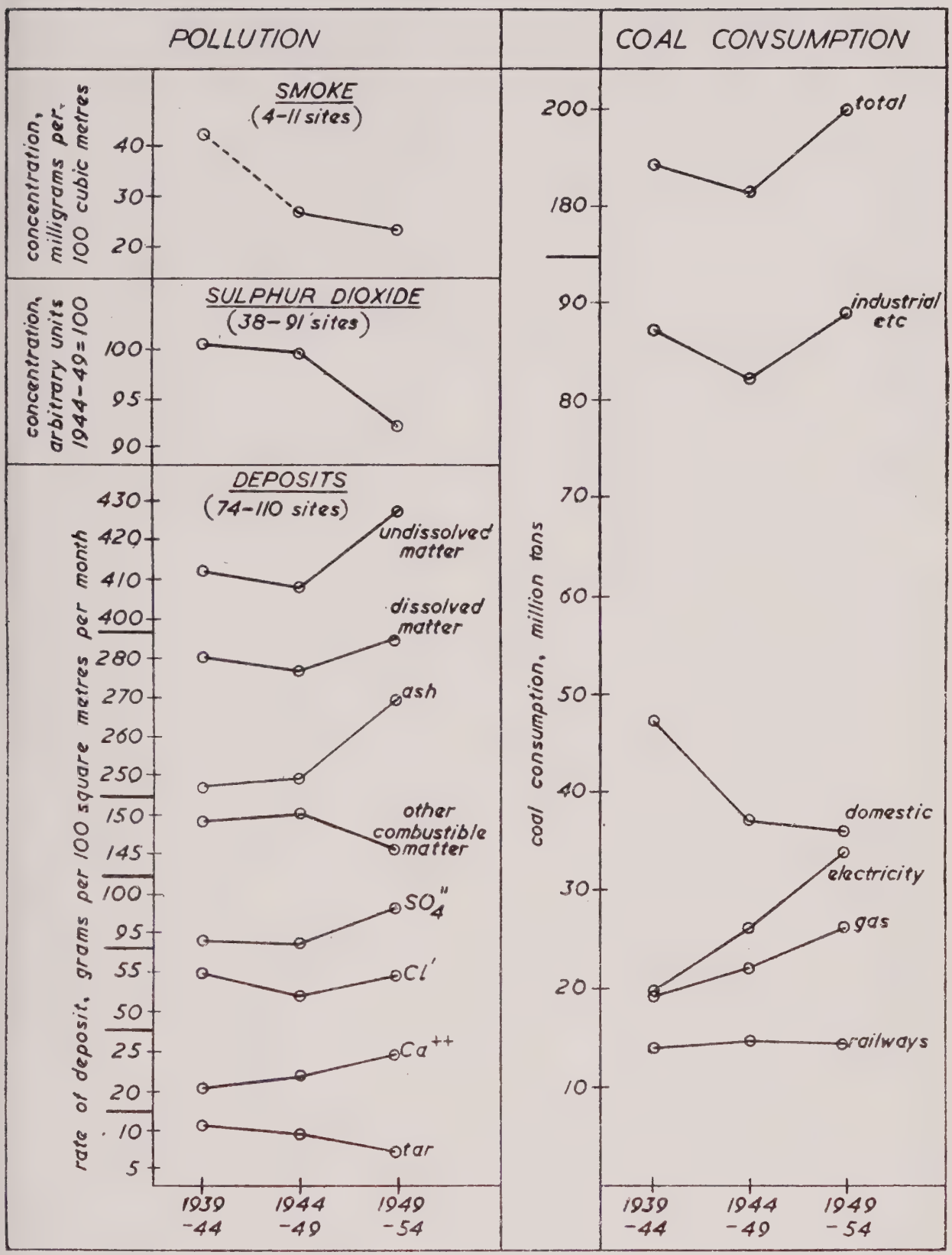
Trends of Pollution

It has always had to be emphasized, and cannot be too often reiterated, that the figures obtained for individual observations have only a restricted significance. Not only are the methods used subject to an appreciable margin of error, but the natural fluctuations in the concentration and deposition of pollution, due to meteorological and seasonal factors, are so considerable that it is only by clumping the figures together over long periods that useful conclusions can be drawn, either on the trend of pollution at a particular site, or in comparing one site with another.

The present report, covering ten years, is able conveniently to take five-yearly means, which are subjected to recognized statistical tests. Although the individual site records are of local importance, it is of course the general changes that can be detected which give the report much of its importance.

For deposited matter, calculated from statistically significant changes only, it is shown that the principal changes in pollution are for *ash*, with an average of 11 per cent. increase, *sulphates* a 6 per cent. increase, and tar (this is calculated from all recorded changes) of 20 per cent. decrease.

Although the number of smoke filters is small, the following figures,



TRENDS IN AIR POLLUTION

A Diagram from the New Report

showing average smoke concentrations in milligrams per 100 cubic metres, are of importance:

Period	*Summer*	*Winter*	*Year*
1944-49	17·2	37·7	27·4
1949-54	13·5	33·2	23·4
Decrease	3·7	4·5	4·0

The trends in pollution by sulphur dioxide, as shown by the volumetric and lead peroxide instruments, show generally a significant decrease, ranging regionally from 5 to 15 per cent. The exception is an increase of 14 per cent. in the north west for the 1944-54 period, compared with a decrease in the same area of 15 per cent. over 1939-49.

These trends in pollution are compared in the report with the changes in coal consumption during the five-year periods 1939-44, 1944-49 and 1949-54, as shown in the accompanying diagram, reproduced from the Report.

The increase in ash (which includes grit) follows the increase in the quantity of coal used by industry, and, to quote the report, " it seems that the effect of improved techniques in grit arrestment has not yet outweighed the increased production of grit at pulverized fuel fired installations." The decrease in the amount of " other combustible matter " (unburnt fuel particles) is attributed to the efforts that have been made to increase efficiency of combustion in those types of industrial plant that are the usual main sources of these deposits. The decrease in the amount of tar—a constituent that although but a small proportion of the total deposit is perhaps of considerable importance in relation to health—is doubtless due to the decrease in coal consumption in domestic fires, the smoke from which is high in tar content.

Suspended Matter

The figures for matter suspended in the air, measured by the smoke filter, are of especial interest in showing the influences of different sources, and their daily and seasonal variations. The present report does not appear to produce any new evidence but it does confirm what has been previously noted. Thus the yearly average results for 103 sites range from 1 mgm. or less per 100 cubic metres in some rural and coastal areas to about 50 mgm. in some densely populated industrial areas. In periods of fog the readings may reach 400 mgm.

At all sites the average smoke concentration during the six winter months was 2·3 times that during the summer months. In mid-winter and mid-summer the ratio averages about 4, but while it is less than 3 in some large industrial areas (e.g., Birmingham, Leeds, Sheffield and Stoke-on-Trent), it is more than 10 in some mainly residential areas (e.g. Teddington, Lytham St. Annes and Hornchurch). The significance of domestic smoke is obvious.

Further pollution during weekdays (Monday to Friday) is on the average greater than at weekends (Saturday and Sunday) by about 30 per cent. during the summer and 20 per cent. during the winter.

The usual daily cycle is repeated in the present report—a minimum of pollution during the early hours of the morning, a rise to peak value later in the morning or early afternoon, with a lesser peak in the evening.

Clean, Dirty—and Filthy

The Report is a scientific document that quite properly cannot be concerned with presenting the facts it contains in the form of propaganda material for the clean air movement. To the N.S.A.S. however, such facts are of importance if they can be used to illustrate the educational work with which it is concerned. For such purposes perhaps the most telling part of the report is the comparison that is given between the six stations that gave the highest deposits, the six that gave the smallest, and the average. Table 3 in the report gives details of this comparison for the different constituents, and also the winter and summer means. Simplifying this by taking only the total solid

deposit figures, and the mean for the year as a whole, the ratios are as follows:

Highest	2,715
Average	710
Lowest	235

These figures are in the units used throughout the report: grams per 100 square metres per month—which (unfortunately) does not mean a thing to the man in the street. For popular appreciation they can be grasped more readily in the older terms of tons per square mile per year, as follows:

Highest	835
Average	218
Lowest	72

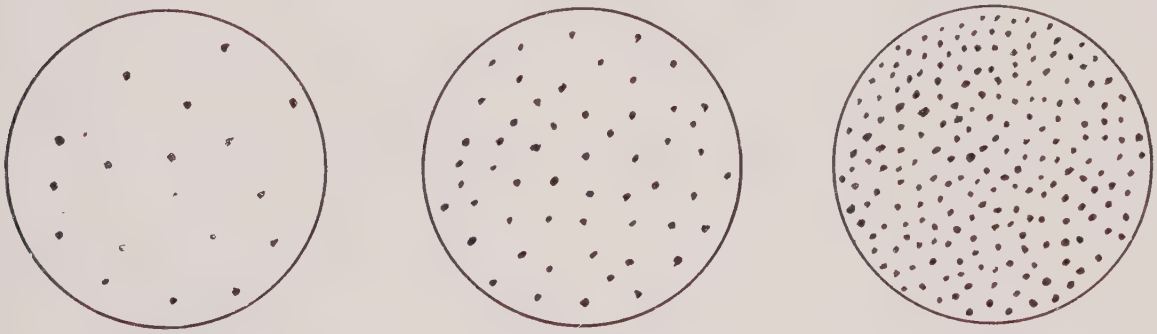
We have attempted to put these comparative figures into graphic, easily visualized form in the accompanying diagram.

There do not, however, appear to be any deposit gauges in areas remote from the main sources of pollution, the observations from which would give figures for the minimal natural pollution we can always expect in these islands. Older records show annual deposits of about one-half the " lowest " recorded here. (It is interesting to note the smoke filter figures obtained at several R.A.F. stations in open country and away from large centres of population or industries, which are of the order of 1 mgm. per 100 c. metres down to " traces " only at Stornoway and Lerwick).

The Behaviour of Sulphur Dioxide

The Report has a note of some importance on the more rapid disappearance of sulphur dioxide from the atmosphere compared with smoke. This may be quoted in full:

" According to the Beaver Report the ratio of the weight of sulphur dioxide to that of smoke is about unity in the products of combustion from domestic coal-fired appliances and about $2\frac{1}{2}$ for the total emissions from fuel-burning appliances generally. At the various sites listed in Tables 9 and 12 the ratios of these two pollutants ranged from 0·4 to 4·0 with an average for all sites of 0·9, thus indicating that the samples collected from the atmosphere contained on the average only about one-third of the amount of sulphur dioxide, or alternatively three times the amount of smoke, that would be expected on the basis of the estimated emissions of these substances. Even when allowance has been made for possible errors of sampling and analysis, the results seem to indicate a considerable preferential removal of sulphur dioxide near ground level, e.g., by absorption by buildings, vegetation, rain, etc., or by diffusion into the upper atmosphere which then carries it out of the survey area. More information is obviously needed on the behaviour and fate of the very large amounts of these harmful substances and on the effectiveness of tall chimneys for dissipating them."



WHAT KIND OF AIR DO YOU BREATHE?

Relative amounts of pollution, based on the published records

The Clean Air Bill

AMENDMENTS SUGGESTED OR SUPPORTED BY THE SOCIETY

The following summary of the principal amendments suggested or supported by the Executive Council of the Society are published as a record of the conclusions reached after the Bill had been studied by the Technical Committee and the Council itself. The Council is not however responsible for the wording of the explanatory notes. There are also later amendments which it is probable will have the Council's support.

Clause 1(1) *and elsewhere throughout the Bill—After "building" to insert "or premises"*

Without such an amendment fuel-burning installations in the open, including incinerators, boiler plant, etc., would be excluded from the provisions of the Bill. Because of the difficulties experienced in actual practice, through the use of the word "building" only, such wording in the Manchester Corporation Act, 1946, was amended to include "premises" in the Manchester Corporation Act, 1950.

Clause 1(3)—*Defences*

The deletion of the whole of this subclause is urged on the grounds that no defences have been specified in any of the existing or earlier smoke abatement legislation or byelaws; that a need for such defences has not previously been called for; and that their inclusion would add substantially to the difficulties of local authorities in operating the Act.

In particular, subclause 1(3)(*c*) is strongly deprecated because, in addition, no definition of "suitable" is given, or would appear to be feasible. The inclusion of a clause of this nature would encourage its use and, because of its lack of precision, would lead to much inconclusive legal argument and difficulty of rebuttal. It may be recalled that the Beaver Committee in their Report (paragraph 27) explicity stated: "Although the coal is often blamed, we are satisfied that coal quality by itself is rarely the cause of excessive smoke."

Failing the deletion of this Clause, the Society urges the inclusion of a provision (in Section 24) requiring that a person who has received notification concerning an alleged offence under the Act shall, if he intends to rely on any of the defences mentioned in S.1(3), give notice of this intention to the local authority within 24 hours after he has become aware of the alleged offence.

This would eliminate the possibility of such a defence being sprung by surprise upon a local authority after the case had gone to Court and when all the circumstances could not be checked owing to lapse of time. The general principle of early notification is incorporated in many Acts and eliminates much waste of time and many abortive legal actions.

Clause 2—*Seven Years exemption from S.*1

It is considered that seven years is an excessively long period for the carrying out of the work necessary to reduce the emission of dark smoke to the extent likely to be required under the Minister's regulations. The work required for the complete abolition of smoke would be a very different matter. The Beaver Committee reported (paragraph 93): ". . . the operation of any new legislation should be deferred for a period of three years from the publication of this Report, which would allow time for any necessary re-equipment in the

great majority of cases."*

The Society supports proposals for a shorter period.

Clause 3(1)—*Notice of intention to install*

The Society urges that this be extended so as to require that notice of intention to install a furnace shall be made in writing to the local authority.

The purpose of this is to ensure that the local authority is kept informed on fuel-burning developments in its district, and to facilitate discussion, where necessary, that may assist in preventing the installation of plant that would fail to meet the requirements of the clause.

Clause 5—*Equipment to arrest grit and dust*

It is considered that the figure to which this shall apply, namely a rate of fuel burning of ten tons an hour or more, is much too high, as there are very few plants burning fuel at this rate. The Society urges that the prescribed figure be reduced and also that a provision be included whereby the Minister may reduce it further if technical means and circumstances should so permit.

Clause 8—*Smoke Control Areas*

The Society urges the deletion of the word " undue " from subclause 4, as this is not a phrase hitherto used in smoke abatement legislation and for which no standard is laid down. Smoke control areas are clearly intended to include smokeless zones (areas in which all smoke is prohibited), but under this subclause it would be possible, by ministerial order, to prevent the creation of any new smokeless zones and indeed to wipe out the existing zones.

Clause 9—*Adaptation of fireplaces in private dwellings*

The Society urges:

In 9(1), *lines* 10 *and* 11, that the words " or occupier of, or any person interested in " be deleted, on the ground that the local authority should deal only with the landlord, leaving the apportionment of cost between him and the tenant to be settled through tenancy agreement.

In 9(2), *lines* 27 *and* 28, that the words " the expenditure is incurred by the occupier of a private dwelling who is not an owner thereof," be deleted on the ground that the clause as at present worded would allow a tenant to move after two years, taking the subsidized apparatus with him.

Clause 11—*Interpretation of Adaptation Sections*

The Society urges that the provision of gas ignition and adequate fuel storage should be specified among the permitted works, or added to 11(1)(*d*).

Clause 12(1)—*line* 5—*Smoke Nuisances*

In any action taken under the clause as it at present reads, it would be necessary for a local authority to produce evidence from " the inhabitants of the neighbourhood " that they were suffering from a nuisance caused by the defendant. In practice this has created undue difficulty, because of the nature of the evidence to be given by inexperienced witnesses, who may be subject to technical cross-examination; and the fact that in some cases the nuisance is experienced at some distance from the source, possibly in streets, working places, etc., without " inhabitants." Statements that the difficulties have been experienced under a similar provision in other Acts can be supplied.

It is therefore urged that the clause be amended so that it reads either, (*a*) ". . . shall if it is a nuisance be deemed to be a statutory nuisance under this Act "; or failing this, (*b*) that the words " to the inhabitants of the neighbourhood " be deleted without further amendment.

Clause 14(3)—*Colliery Spoilbanks*

It is urged that the clause be amended so that action can be taken in the case of abandoned spoilbanks.

* The Report did in fact also suggest exemption certificates which " should cease entirely after seven years from the passing of the Act."

Clause 15—*Railway Engines*

It is urged that works locomotives, mobile cranes, etc., be included after " railway locomotive engines," unless it is certain that, in law, they are in fact covered by these words.

It is also urged that in subclause 2 the words " or person in charge " be added after the word " owner."

Clause 16—*Vessels*

The Society is of the opinion that subclause 3(*b*) as at present worded is ambiguous and may be construed as limiting the section to " all waters navigable by sea-going ships which are contained within any . . . place so long as a person or body of persons is empowered by, or under, any Act to make charges," etc.

It is therefore urged that this subclause be re-drafted.

Clause 17—*Crown Premises*

In 17(1) it is considered that local authorities should in all cases report to the Minister of Housing and Local Government, who shall submit the matter to the responsible Minister.

The Society is also concerned about the position of premises that are under the control of Agents, and in particular that of hospitals, and urges that these and other similar premises be specifically excluded from the Clause.

Clause 18—*Building Byelaws*

A provision similar to this was included in the Public Health (Smoke Abatement) Act, 1926, and repeated in the Public Health Act, 1936. No such byelaws have been drafted in a way acceptable to the Minister and the clause has become wholly a dead letter. It is considered that its inclusion in the present Bill will be of no value unless such byelaws are made obligatory, and the Society therefore urges that in the first line the word " may " shall be replaced by " shall."

Clause 19—*Powers to Local Authorities*

It is urged that the powers given to a local authority be broadened to allow it to co-operate with other local authorities and other bodies in matters of publicity.

Clause 24—*Notification of Offences*

It is urged that the words " twenty-four " (line 30) be replaced by " forty-eight," on the ground that difficulty can arise, especially at the week-end, if notification has to be given within 24 hours.

Additional Clauses

The Society urges, and supports, the addition to the Bill of further clauses covering the following matters:

Clean Air Council

Provision in the Bill for the constitution of a Clean Air Council for the purpose of giving advice and assistance to the Minister, and for the annual report of the Council to the Minister to be laid before Parliament.

Such provision in the Bill will ensure that the Council remains in being and active.

Annual Reports of Local Authorities

The Society supports the proposal of the Beaver Committee that annual reports of their activities in relation to clean air be made by local authorities either to the Minister or to the Clean Air Council, and urges that this be provided for.

Training and Certification of Furnace Operators

The Society urges a provision requiring furnace operators and boilermen to hold, for designated plant, a recognized certificate of proficiency.

Height of Chimneys

A provision to be included governing the height of chimneys, similar to that embodied in a number of local Acts and included in Model Clauses, 1953, (Clause 65).

Sulphur Fumes

The Bill has been criticized because it contains no reference to the control or reduction of sulphur oxides and acids arising from the combustion of fuel. While agreeing that the difficulties of such action should in no way delay the reduction of smoke and grit

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Obituary

NORMAN ABBOTT

It is with much regret that we have to record the death, in September last, of a very good friend of the Society, Mr. Norman Abbott, Chartered Accountant. Mr. Abbott, through his firm of Abbott and Son of South King Street, Manchester, had acted as Honorary Auditor for the Society since its formation in 1929. In fact, with his father, he had before then helped the former Smoke Abatement League of Great Britain in the same way. In addition to the important task of annually auditing the Society's books he had always been ready, in the most friendly and helpful way, to advise us on our financial business and arrangements, and although the Society's accounts have in recent years grown considerably larger and somewhat more complicated than in the early days, he had not wished to change the honorary basis of the work.

Since he sought no recognition, and did not attend meetings, Mr. Abbott was known to few of the Society's members, and it is perhaps because of this that we wish to emphasize as much as possible the appreciation and gratitude that is due to him from the Society. He was of a retiring disposition, a very good pianist, and a lover of the mountains—walking on the fells on every possible occasion. He was also a bird watcher of some distinction, and took a keen interest in the Society for the Protection of Wild Birds and in the National Trust. His services for the National Smoke Abatement Society were a practical expression of his interest in its work and fortunes. He left a widow, a married daughter and an unmarried son, to all of whom our sincere sympathy is extended.

We are pleased to be able to say that the other partners of the firm, Mr. William Scott and Mr. F. R. Terras, have very kindly agreed to continue with the Society the arrangement for audit that Mr. Abbott maintained for so many years.

Dr. William Barr

We regret to record the death, in December last, of Dr. William Barr, who until his retirement in 1952 had been Medical Officer of Health for Rotherham. He had a distinguished career, and although not closely associated with the Society, did much to foster the prevention of air pollution. He had helped to inaugurate the Sheffield, Rotherham and District Smoke Abatement Committee, and for some years was Chairman of the Standing Conference of Co-operating Bodies on air pollution with the D.S.I.R.

Alderman T. M. Larrad

It is also with regret that we learn of the recent death of Alderman T. M. Larrad, for many years a member of the Manchester City Council and Chairman of the Manchester and District Regional Smoke Abatement Committee. He had a keen and practical interest in smoke prevention, and as Chairman of the Health Committee had much to do with the successful inauguration and development of Manchester's smokeless zone. He had been a member of the Society's Executive Council and had attended many of its conferences.

Smog in New Orleans

Two asthma patients died and more than 200 others were rushed to hospital on 26th October last, when smog and other atmospheric conditions created the worst conditions for asthma sufferers in many years. A doctor at Charity Hospital said the line of asthma victims to the emergency room, lasting from midnight to dawn, was the worst in memory.

Clean Air Bill—*concluded*

that is immediately possible, the Society is of the opinion that it would be of value to include in the Bill a clause allowing the Minister to make regulations for reducing the emission from chimneys of sulphur gases or fumes if and when he is satisfied that practicable methods exist.

"SCIENCE AGAINST SMOG"

On Friday, 27th January, the B.B.C. Home Service broadcast a feature called " Science Against Smog," which lasted from 7.45 to 8.15 p.m. As the B.B.C. estimate that talks at that time on a Friday evening may reach up to a million people, this programme may be regarded as a very useful contribution to the campaign for Clean Air.

The narrator, James McKechnie, led listeners from one aspect of the problem to another. Each aspect was dealt with by a different speaker; among the latter were several prominent members of the Society, namely Dr. R. Lessing, a M.O.H., and Mr. A. Wade of Nottingham.

The programme began dramatically with the voice of a young doctor describing his distress at the death of one of his first patients from the effects of fog. Sir Graham Sutton, Director of the Meteorological Office, then described the atmospheric conditions which create smog.

From meteorology and Sir Graham, listeners were led by Mr. McKechnie and " Fido " (the war-time fog dispersal method) to Dr. G. Elton, Director of the Fog Research Unit. Dr. Elton told how, mainly because of the intermittent nature of fog, he and his assistants had been obliged to construct a 27,000 cu. ft. chamber, in which to create and disperse artificial fogs. He also spoke of the difficulties of applying any solution on a large scale, but ended on an optimistic note by saying that he hoped to make a statement on the possibilities in the near future.

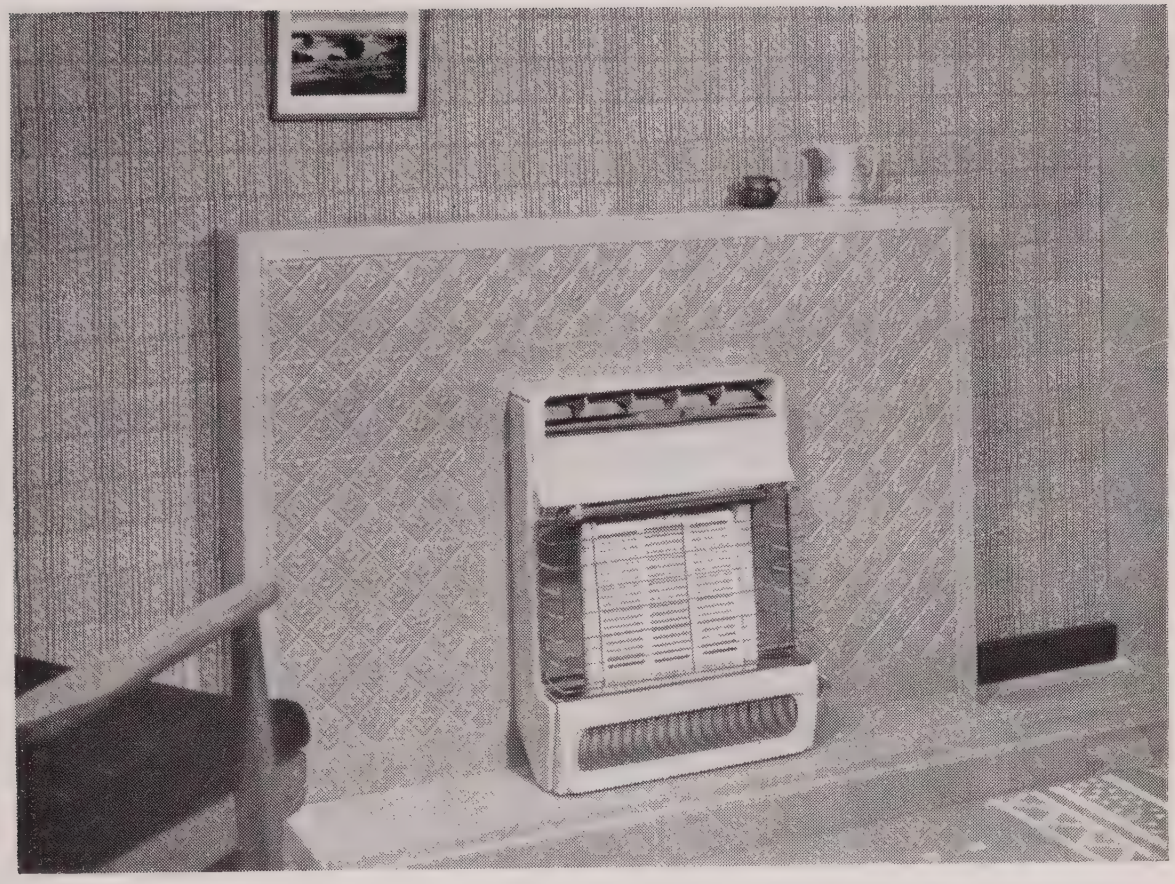
The next authority to speak was Dr. Wilkins of the Fuel Research Station, who described the three types of investigation carried out by the Station; the close examination of the constituents of fog, the analysis of the figures which come in from the regular network of instruments all over the country, and the special new smog surveys conducted with the help of Civil Defence volunteers. One of these volunteers, a Mrs. Gallop, told how she had assisted in taking measurements on the roof of the House of Commons during a recent smog.

Dr. P. Lawther of St. Bartholomew's Hospital then talked about research into the effects on health, and the difficulties of determining which elements in smog actually cause the damage, and how they cause it. He gave a startling illustration of the experiments conducted by himself and his colleagues, in which he allowed listeners to hear the change in his breathing after inhaling fifty times the amount of sulphur dioxide found in smog.

Then came an anonymous Medical Officer of Health, whose personality, however, was not concealed for those who knew him. He spoke of the increased death rate from lung cancer in cities, the loss of sunlight through smoke, and the effects on plant life. There followed the equally well-known voices of Dr. Lessing and Mr. Wade. Dr. Lessing described the method of removing sulphur dioxide from flue gases, as practised at Battersea, Fulham and Bankside. Mr. Wade enumerated the many advantages gained by the tenants of the Clifton smokeless estate at Nottingham.

Finally, Mr. Hopthrow, Chairman of the Atmospheric Pollution Panel of the Federation of British Industries, spoke of the measures which could be taken by industry to reduce its smoke output.

It was altogether a first-class programme, which gave the ordinary listener an interesting insight into the methods and difficulties of those who are tackling the smoke problem. It was also well-balanced, largely because the main speakers were authorities in their own fields, and could be trusted not to ride off on some individual hobby horse.



THE " GASMISER "

The use of gas as a domestic smokeless fuel to replace the open coal fire has been limited, where cost is a main factor, to intermittent use. For continuous heating the solid fuel fire has always scored. If however the useful heat efficiency of the gas fire can be improved the picture may be changed. The photograph illustrates the new " GasMiser " gas fire of Messrs. Cannon (G.A.) Ltd. Its outstanding feature is the " Multyjet " hot air convector incorporated in the design, which is of a new type and is said to make it possible to use gas for continuous room heating at a lower cost than that of a coal fire. The convector will heat 1,500 cubic feet of air per hour to a temperature of 200°F.

The fire has three heating rates, all clearly marked on the control dial—" super heat " at 36 cubic feet per hour, normal rate at 22, and " miser rate " at 12 (C.V. 500 gas). At the lowest rate only the central heating panel of the three is in use.

Some interesting comparisons with coal are given by the makers. It is estimated that a coal fire burning 15 hours per day would consume one ton of Grade 3 coal in 70 days. The cost of this (in the London area) would be £8 6s. 0d., or 16s. 6d. per week. Using the GasMiser at the three different rates, according to average domestic requirements (down to miser rate for 8 of the 15 hours, and one hour at super heat first thing in the morning), the daily consumption of gas is 1·32 therms, or 12s. 10d. per week. For the same expenditure required for 70 days coal heating, there will be 91 days gas heating.

The combination of radiant and convection heating, plus the three controls, enables gas to be used in the most controllable and economical form. The fire is very attractive in appearance and finish, and is of course constructed to high " Cannon " quality. The price, including purchase tax, is £29 18s. 10d.

Symposium on Coke

The Problem of Supplies for the Clean Air Programme

The Institution of Gas Engineers, at its Autumn Research Meeting in November last, held an important symposium of papers on the key questions of the supply and quality of coke in the light of the requirements envisaged by the Beaver Committee in its programme for domestic smoke prevention through smokeless and "smoke control" zones. More depends on coke than on any other solid fuel, and it is important that all concerned with the clean air drive should be aware of the practical problems that are involved and how they are being attacked. The following account of the symposium is an abridgement of an excellent and well-informed review in the December issue of *Coke and Gas*, from which it is reproduced by kind permission.

THE gas industry, as the result of the report of the Committee on Air Pollution which was issued a year ago, has found itself faced with the need in the national interest to provide the smokeless fuel required by the Government's acceptance of that report. To do them justice, the Gas Council have faced the task not only with resolution but with enthusiasm. The need to switch attention to coke has come, curiously enough, at a time when the idea of making gas without producing coke for sale is gaining ground. The need for using more oil in this country for a variety of purposes cannot be gainsaid. The gas industry has many lines fishing in that water: total gasification of coal, the manufacture of gas from oil, and search for indigenous natural gas, the importation of liquid natural gas.

The impact of total gasification

The appendix to the Beaver Report on the availability of smokeless fuels, an appendix based not on assumptions, as was inferred by one author in the Coke Symposium, but on evidence from the nationalized fuel industries and others, set out one method by which the necessary smokeless fuel could be obtained, involving *inter alia* the carbonization of an additional 10 million tons of coal annually, the increase taking place over the next 10-15 years. The gas industry, like other industries, is being urged by H.M. Government to use oil and until some national policy is announced whereby oil is marshalled to the best advantage, it is difficult to resist this pressure. The Beaver Report was issued before that pressure became severe. The Gas Council having embarked on a limited policy of securing gas without coke, and conscious of the fact that "under present conditions" gas cannot take the winter space heating load, nor would most consumers be content that it should, is trying to fit the need for making a greater quantity of coke available into the pattern of total gasification of oil (and perhaps, one day of coal): If natural gas were discovered in quantity, or could be imported at, say, 3d. to 6d. a therm, the position would change quickly in favour of the extended use of gas as in the U.S.A. and the folk who now demand an open fire would adapt themselves in due course to a gasfire. Those developments are in mind but out of sight. Meanwhile we must be practical and use what we have. It should also be made clear that the problem is not only to supply "coke" but to supply

coke suitable for the open fire, and that introduces the problem of quality.

Coke transference

The Deputy Chairman of the Gas Council made it clear that the papers presented in the coke symposium were based on the work of the panel appointed by the Gas Council in January 1955 " to investigate any production techniques or processes which would increase the quantity of gas coke available for sale, particularly to domestic consumers," but were not necessarily the views of the panel. The Gas Council, in its evidence to the Beaver Committee, visualized " switching " 4·6 million tons of gas coke from other users to the domestic market. This will introduce problems of some magnitude, especially since it will involve (*a*) that the transfered coke must be suitable for the domestic market and (*b*) that the present users, faced themselves with the industrial provisions of the Clean Air Act, will be disinclined to give up a smokeless fuel for a fuel that may run them into trouble from dark smoke. This is a field for the extended displacement of industrial coke by oil, and for the co-operation of the coke-oven owners who can produce industrial coke more readily than open-fire coke. Seasonal demands which characterize the domestic market will also lead to problems that require solution.

Coal supplies

Appendix XI to the Beaver Report, based on factual evidence, showed that the coal needed for an extension of carbonization could be obtained from several sources; additional information has since come to light that more than half the large coal used by the railways and domestic consumers is of carbonizable quality. At the time that this report was issued there was pressure to conserve large coal for export. Since then, the export of coal has been dropped as official policy; the paper previously quoted shows that unless there is a trade depression we shall always in future be a fuel-importing nation. More emphasis can therefore be placed on the use of displaced house and railway coal for carbonization than was possible a year ago. The Gas Council's progress report, for such H. F. H. Jones's* paper " Coke in the Domestic Market " can be deemed, fully supports the Beaver Committee's view that there is plenty of carbonizable coal in the country: " It is not a shortage of carbonization coal as such that presents a problem."

Additional coke from present sources

The Gas Council has followed the procedure of Appendix XI of the Beaver Committee. In compiling that appendix, in order to assess the possibility of providing the necessary smokeless fuel, all sources of solid smokeless fuel (existing and projected) with a reasonable allocation to gas and electricity, were first thrown into the scale. There was then found to be a deficiency, which could be made good by the carbonization of an additional 10 million tons by the gas industry. In the same way, the Gas Council's committee has sought by every possible means for sources of additional coke from existing plant, leaving the deficiency to be produced by carbonizing additional coal in new plants. The present symposium is partly concerned with such problems, and partly with the equally important problem of producing open-grate coke of a quality that will satisfy the consumer, and in the consideration of the economics of such measures as might be taken.

Additional coke, disregarding the problem of quality, can be made available for sale by several means which can be summarized (Table I) from H. F. H. Jones's paper.

The gas industry would welcome the greater use of gas, and obviously will make every effort to increase domestic gas consumption. This would be welcome for another reason; town gas can be purified from sulphur, whereas solid fuel and oil cannot, while power

Method	Extra coal needed annually	Extra coke made available
	million tons	million tons
Reduction of the proportion of Carburetted water gas	1·54	1·14
Operating carbonization plant at higher load factor (83 per cent.) using surplus coal gas for heating the retorts	0·54	0·38
Coke now used for steam raising, etc., replaced by breeze and waste heat system	Very small	0·35
The use of the carrier-gas process	not assessed	
Raising the C.V. of town gas thus making more coke available for sale for a given production of gas ..	1·00	1·00

TABLE I

station operators are unwilling to remove sulphur from their flue gases. H. F. H. Jones was clearly confident that within 10 or 15 years, under present circumstances, gas could replace much of the house coal now used in black areas—to say nothing of the rest of the country. Moreover, as the result of the enquiry summarized in Table I, he concluded that

> although some additional coke can be made available for sale without the carbonization of additional coal . . . only by additional carbonization can really substantial additional quantities of coke be placed on the market.

That is a most important conclusion, fully in line with the views expressed in Appendix XI of the Beaver Report.

The cost of additional coke

The Beaver Committee envisaged that additional costs would be incurred in making open-grate coke, and suggested that the premium fuel so produced might require to command an additional price of up to £1 a ton. H. F. H. Jones pointed out that the price obtained for coke in the past has been such as to pay for no more than its own weight of coal.

> This means that the coke made for sale, perhaps 7 cwt. to 10 cwt. a ton of coal, has paid for its own weight of coal, leaving the remainder of the ton of coal to be paid for from revenue from gas and other products, and all works' charges for labour, maintenance and capital to be borne by products other than coke, which escapes scot-free. As a result, the producers of gas coke have often received no return for the work which has been done on the raw material, coal, to give a cleaner solid fuel, coke, which is not only smokeless, but often more efficient in use than the high-volatile coal from which it has been made . . . If coke production is to be increased, the revenue from coke must be such that the carbonization process remains economic as a method of gas manufacture; otherwise, the gas industry will turn more and more to processes of complete gasification using low-grade coal, oil or refinery gases as raw materials. In this event, efforts will no doubt be directed to devising better means of meeting the winter space-heating load by gas alone.

Should we be right in reading into this passage an ultimatum to the powers that administer the Clean Air Act and to the nation that the gas industry expects the price of coke to be very materially advanced? The consumer should pay a fair price for his fuel. He will be relieved of a great deal of cost and his living conditions and health will be improved. For these benefits he must expect to pay. The conclusion is surely that the whole operation must be commercially sound. The gas industry might market its improved fuel under a "trade name" attractive to the consumer, and it must adopt modern marketing techniques to persuade the consumer of the value and desirability of the product—thus following the example

of the producers of low temperature coke.

On the score of capital cost, plant to carbonize 1 million tons of coal a year on a green field site is estimated to cost about £15·5 million. If 10 million tons of additional coal are to be carbonized, this would be the annual expenditure over the next 10 years. Part of the plant already planned to take the normal increase would no doubt be used to meet the smokeless fuel needs under the Clean Air Act. The Gas Council's own estimate is that over the next 7 years, there should be a capital expenditure on fixed assets of £23·695 million a year. H. F. H. Jones has concluded that

> Much of this money may be required for the construction of plant to replace existing plant which is becoming obsolete, but by a re-planning of development programmes it may be that more than £4 million out of the average annual outlay of £23,695 million could be set against the " clean air " requirement of £15·5 million.

Factors affecting coke availability in gas manufacture

Dr. J. Burns gave a comprehensive survey of the extent to which the availability of coke is affected in gas manufacture by the several features of plant design, practice and raw material. He concluded that the coal/coke price ratio is the chief economic factor, thus reinforcing H. F. H. Jones's warning that the price of smokeless fuels must be adequate. When coal is dearer than coke it is advantageous to reduce the amount of coal carbonized, to use the coke for water gas production, and to make gas of low calorific value. When the price of coke is higher than that of coal, it pays to make coke for sale and gas of high calorific value.

The conclusion that seems inevitable from Dr. Burns's valuable analysis is that whilst there are many technical possibilities of increasing the production of coke from existing plant, the economies of so doing are often questionable, and the bulk of the new production of smokeless fuel, other than transference from industrial users to domestic users, must be through building new carbonization plant. Transfer will in itself involve new problems and additional costs. A great deal will depend on producing a really satisfactory type of solid smokeless fuel, and inducing the public to pay an adequate price for it. The success of the clean air movement will depend on the success with which this delicate problem involving production and commercial policy is solved.

The review then discusses more technically detailed papers—on the production of open-fire coke from high-rank coals, by J. E. Davis; on the application of the new " Carrier " gas process to the production of solid smokeless fuel, by W. Hodkinson; and on the carbonization of low-rank coals in continuous vertical retorts, by W. R. Branson and E. T. Pickering.

Coke in use

Finally, as the conclusion to the discussions on coke production, F. A. Burden and F. J. Eaton discussed coke quality in relation to appliance performance.

Analysis of complaints has indicated that coke should be of good appearance, free from dust and well sized. Segregation in hoppers which at some period overload the sizing screens seems to be the probable reason for sizing complaints. Few complaints are made on grounds of moisture content. The appliances used are satisfactory, well installed and easy to operate. Reactivity does not seem to be a factor with the open fire when operating at high output, but is important in ignition and ability to keep alight at low bulk. (It is probably, in our view, also important for rapid recovery after refuelling.)

An important point made is that appliances should be tested for approval on a coke of only moderate reactivity. The test coke used in the Fulham laboratories is made from Durham coal, and has a C.A.B. value

of 0·054 to 0·066 for the No. 2 size, and 0·050 to 0·062 for the No. 3 size. Experience has shown that appliances proving satisfactory with this test coke will provide satisfactory service with all gas cokes complying with the recommendations of the Gas Council Coke Quality Report.

The most important characteristics of an open-fire coke are that it should be readily ignitable and readily controlled to low rates of burning without going out; the " lively " fire, with much flame, which is preferred by many people, may be obtained with the more combustible gas cokes at the expense of about three units of efficiency. This is more marked with low-temperature cokes, for which the increase in flame and free-burning properties is accompanied by a reduction in efficiency of some six units. Both ignitability and combustibility are related to the reactivity of the coke substance, bulk density and sizing. It is well established that for a given coke the 1 to $1\frac{1}{2}$-in. fraction will ignite more readily and burn more freely than any other size.

This paper seems to indicate a certain degree of complacency on coke quality. For example:

> it may be deduced that coke from the carbonization of Durham coals in horizontal or intermittent vertical retorts and sized 1 to 2 in. is likely to require some 7000 B.Th.U. of gas for ignition and would give a good fire in 45 to 50 minutes. This time might be reduced to 40 to 45 minutes by the use of a closer size range, 1 to $1\frac{1}{2}$ in., with the same quantity of gas. The lighter cokes prepared from low-rank coals are for the same sizing more easily ignitable and more free-burning, but these cokes may be made to give a performance approaching that of the cokes of higher bulk density by increasing the upper limit of size. To many, it may seem heresy to reduce deliberately the ignitability and free-burning properties of coke that can be produced by a particular carbonizing plant and type of coal, but if by doing this the performance of coke, from whatever the source, is more consistent, such a policy may well be to the advantage of coke marketing as a whole.

It would seem that the authors regard almost any coke produced in the London area even from Durham coals in static retorts, as satisfactory to the average domestic consumer. It may be true that the number of complaints received is limited, but how many people do not complain, but just return to raw coal? Moreover, Dr. Burns indicated that C.V.R. coke is reserved for open fires. Experience has shown that the domestic consumer is satisfied when he or she receives a C.V.R. coke made from Midlands coals; how much further down the scale one can go remains to be seen, but it is no doubt related to the habits of people. If people only need a fire to sit around at night, a harder coke with a deep firebed may satisfy them. But they will need a more reactive fuel in an appliance that burns all day, during periods of which it may receive no attention.

Conclusion

It is apparent, as has been indicated previously, that the gas industry is taking the question of coke quality very seriously. The need to implement the Clean Air Act is now evident and although the pace at which smoke control areas will be instituted must be geared to the rate of coke production, if there is any long delay the opportunity may be lost, either to other fuels or absolutely in the sense that local authorities will lose interest.

The success of the Clean Air operation depends on people being satisfied and while the production of smokeless fuel must be within practical limits of cost, we believe that the public can be induced to pay a moderate additional price for a better product. But it must be a better product. The coke that is supplied need not be of the free-burning character of low temperature coke, but it must be satisfactory in use.

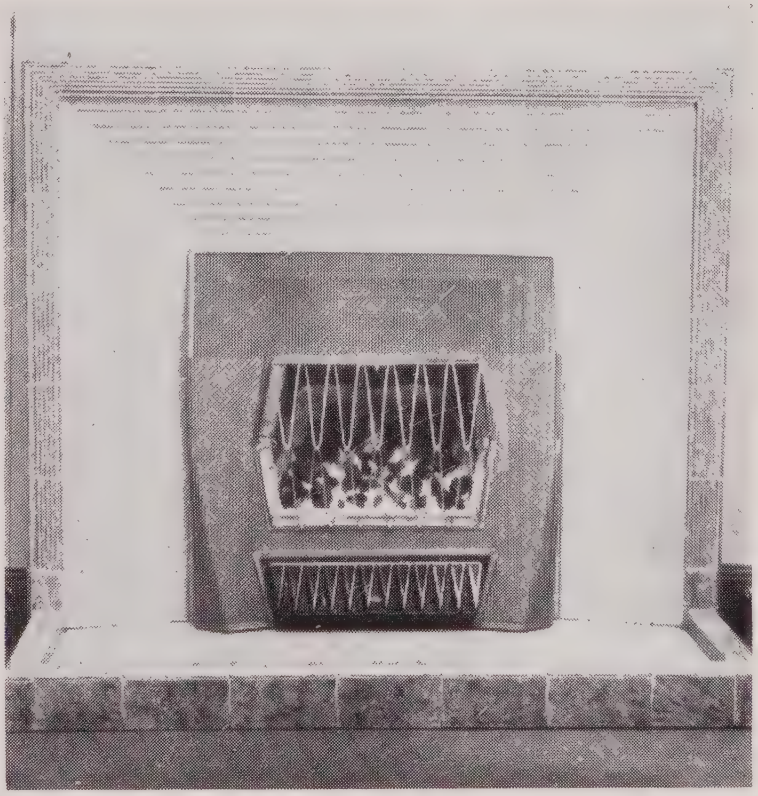
The provision of the necessary appliances is an essential feature of any smoke control area, and it has been demonstrated at many housing estates that a coke of reasonable quality, as described in some of the papers presented to this conference, will be satisfactory once those who have to use it have received some instruction.

This symposium has focused attention on coke. That is all to the good. It has also shown that while something can be done to provide more coke from existing plant, the bulk of the smokeless fuel must come from new plants. The use of low-rank coal has been examined, but as yet indecisively. It can be carbonized successfully, but at a cost. Blending is also feasible, but the transport costs on either the low-rank coal or the good coking coal may rule it out on economic grounds. It seems inevitable that if the public require a really reactive coke made from low-rank coal they will have to pay much more for it. A satisfactory coke can be made from traditional coals by traditional processes. The coal is available. The National Coal Board can supply it. One of the major decisions is commercial; at what price can a good and satisfactory smokeless fuel be made available to the public. Another problem that will arise is that of erecting the new plants in the places and at the right times to fit in with plans for the development of smoke control areas.

A New Open Fire

The Newton Chambers Company, of Thorncliffe, Sheffield, have just introduced a new " Redfyre " open convector fire. It consists of an open fire unit (with adjustable restricted throat) which fits into practically any hearth, 14 in. to 20 in. wide, so that the space between the unit and the original fireback and sides becomes a convection chamber, the warm air from which circulates continually into the room. The further novel feature is the mesh convector screen that clips in front, overlapping the gap behind and fitting flush with the surround. There is also an easily-removed guard to fit across the fire opening.

The two-part arrangement is both ingenious and effective, and makes it possible to fit the fire with a minimum of cost and trouble. The fire itself is of course designed to burn any smokeless fuel and the heating efficiency—radiation plus convection—is excellent. The fire also cleverly combines a modern style with the appearance of the traditional open fire. It should appeal both to the individual user and to the local authorities, both in new housing and in making conversions in smoke control areas. The cost is £11 17s. 6d. retail.



"DRY FOG"

A communication of interest and importance, entitled " Some Observations on London Fogs," by R. E. Waller and Dr. P. J. Lawther, was published in the *British Medical Journal* of 3rd December, 1955. It describes observations made on 9th January, 1955, when visibility was reduced to 70 yards in parts of London, although the relative humidity remained low and no water droplets were present. It was stated that there was a definite smell of coal smoke and that it was noticeably irritant.

Measurements of smoke and sulphur dioxide by different instruments were made during the period and a diagram shows how between 2 p.m. and 4 p.m. the concentration of smoke increased tenfold, and that another rapid rise occurred between 6 and 8 p.m., reaching a maximum figure of 6·5 mgm. per cubic metre. The variations in sulphur dioxide was less marked but the concentration reached a maximum level of 1 part per million.

Microscopical examination of thermal precipitator and cascade impactor samples showed that the suspended matter consisted almost entirely of black smoke particles. Most of the mass consisted of particles of less than one micron diameter. No water droplets were observed and no sulphuric acid was detected in washings from impactor slides, although it was possible that any present in extremely small droplets may have escaped detection. Smoke collected on plates of an electrostatic precipitator contained 44 per cent tarry matter soluble in acetone and seven per cent incombustible ash.

Reports were received from a series of patients with an established diagnosis of chronic bronchitis and emphysema who attend a special clinic and who have been given diaries to record their own assessment of their day-by-day state of health by means of a simple code. Their reports, together with clinical impressions reported by physicians seeing outpatients at two hospitals, say the authors, " leave no doubt in our minds that the smoke was deleterious."

Discussing their observations, the authors state:

" The smoke ' fog ' reported differed from the ordinary London fog in that it was dry and appeared to be free from sulphuric acid. It did however have a marked effect on some bronchitics who were exposed to it. Its chief feature was the rapid variation in smoke concentration and the very high peaks reached."

It is pointed out that measurements of pollution over 24 or 48 hour periods do not necessarily indicate the hazard to which the population may be exposed.

We understand that other investigations on many recent fogs in the London area have also shown that the reduction of visibility is due to smoke alone, with an absence of any detectable water droplets.

Land, Air and Ocean

This is the title of a new text-book by R. P. Beckinsale, Senior Lecturer in Geography at the University of Oxford (Duckworth, London, pp.370 and plates, 25s.).

Although primarily written for students at universities and training colleges this book should be of interest to those of our readers who are interested in the atmosphere and weather, and the land and seas and all their many features and phenomena. It is divided into sections dealing with the terrestrial globe, the atmosphere, the oceans, the land surfaces, and finally the climate near the ground. The last deals briefly with atmospheric pollution and other consequences of the built-up areas that man has created for himself. The book contains a vast amount of lucidly written information on our natural environment and is illustrated with numerous diagrams and photographs (some of these are of remarkably good quality). It is also excellently produced.

HOW INDUSTRIALIZATION CAN ALTER SPECIES

An interesting article by Dr. H. B. D. Kettlewell, in the December issue of the popular science magazine *Discovery*, describes how the black varieties of certain moths—" industrial melanics " as they are called—are supplanting the ordinary light coloured varieties in industrial areas. This is said to be the most striking evolutionary change to be witnessed in any organism, and is being investigated at Oxford University.

The increase in deposited pollution on the countryside in industrial areas and in particular on the foliage and trunks of trees, causes blackening of the latter, against which the lighter varieties of moth stand out clearly. Hitherto, these light varieties have been protected from predators by the way in which they blended with their natural surroundings, particularly lichens. So that although the black moths are eugenically dominant, they have been kept in close check by their enemies. Now, however, they are placed in a favourable position by the industrial blackening of their surroundings, and this, combined with their natural dominance has caused a great increase in their numbers.

At the end of his article, after describing the experiments conducted by himself and his associates, Dr. Kettlewell says: " there can be no doubt that cryptically a melanic insect is, on the average, at an advantage on the black bark of pines; possibly this is one reason why it has not been eliminated from this habitat (the Black Wood of Rannoch). In fact, the presence of conifers, which cannot grow thallose lichens freely on their trunks and which accumulate pollution on their leaves, may play a considerable part in the recent spread of industrial melanism. But its present increase is due to the pollution of tree trunks other than pine; these are denuded of lichens so leaving the moths exposed upon the trunk.

It is possible that these black mutants, now multiplying their numbers throughout our countryside, may have in the past populated vast areas under conditions which were very different from those of today, but nevertheless advantageous to them. Their present state of dominance could thus have evolved during a period before the advent of the Romans, when England was pine-covered, or when lichens were fewer, or when there was less sun and more cloud. The Scottish melanics may, in fact, be a relict from them. Their increased viability and other physiological differences may be connected with that period. The black mutants have now spread far beyond the boundaries of industrial areas, but always to the east, following the pollution drift. Nowhere down the east coast of England have I found the black form of the Peppered Moth at a lower frequency than 50 per cent of the population, and this probably bears a relation to the true degree of pollution in these areas.

" Within a hundred years, if pollution increases in the British Isles and the rate of melanic spread continues, 99 per cent of the population of many species of moth may be black. Our evidence shows that these melanics have different habits, scents and behaviour patterns to their recent forbears. Isolated as they are in Britain, it is possible that the status of new species may be attained by some of these forms much more rapidly than we have ever envisaged."

Among the recipients of the Fellowship of the Royal Society of Health recently conferred, are Sir Hugh Beaver and Sir Roger Duncalfe, formerly chairman and deputy chairman respectively of the Government Committee on Air Pollution; and Mr. James Goodfellow, Chief Sanitary Inspector, City of Leeds and Hon. Secretary of the Yorkshire Division, National Smoke Abatement Society.

THE DIVISIONS

The **North West Division** held a joint meeting with the Merseyside Sub-Section of the Institute of Fuel, on 24th November, 1955. Mr. J. Waterhouse, Chairman of the Institute of Fuel Sub-Section, presided, and was supported by Mr. H. V. Cass, Chairman of the Division.

The meeting was addressed by Mr. J. S. Hales (Director of Industrial and Domestic Development Laboratories, B.C.U.R.A.), who dealt with heating systems both for new and existing buildings. The many facts, figures and illustrations contributed to a most interesting lecture. It was followed by a stimulating discussion, and it was with great reluctance that the meeting was brought to a close.

The Division also held a joint meeting with the North Western Section of the Institute of Fuel, on 8th February. The meeting was addressed by Dr. W. Idris Jones, C.B.E., Director General of Research, N.C.B., who spoke on "Some recent advances in fuel research." A visit to the Leigh works of British Insulated Callenders Cables Ltd. is to be combined with the next Divisional Council meeting on 23rd February. The A.G.M. of the Division is to be held on Thursday, 31st May, 1956, at 2.30 p.m.

The **Yorkshire Division** held its ninth Annual General Meeting at Leeds on 21st November, 1955. The following officers were elected: Chairman: Mr. A. C. Saword; Deputy Chairman: Mr. E. J. Winfield; Hon. Secretary: Mr. James Goodfellow; Hon. Auditor: Mr. J. H. Robinson. A tentative programme for the next session includes: visits to Wakefield, Bradford and Barnsley, to Newton Chambers or Radiation Ltd., and a visit and meeting with reference to diesel engines and the fumes therefrom. A joint meeting with the Institute of Fuel is also contemplated.

Mr. James Law, retiring Chairman, addressed the meeting and reviewed the changes that had occurred during his 25 years as Chief Smoke Inspector. Of the Clean Air Bill, Mr. Law said that it had awakened the spirit of co-operation which was essential to the proper working of its provisions. In concluding Mr. Law remarked that although he had not sought re-election as Chairman of the Divisional Council he was not divorcing himself entirely



Mr. J. S. Hales, Mr. J. Waterhouse and Mr. H. V. Cass at the Liverpool meeting mentioned above

from the work he had a great interest in, and he was anticipating a great forward movement in the near future.

The Chairman introduced Professor M. W. Thring, Professor of Fuel Technology at Sheffield University, who gave his address "Methods of Burning Coal Smokelessly." Professor Thring outlined the practical methods of eliminating smoke at the source and then described the various types of mechanical stokers and gave details of their respective efficiency. Of great interest to many members was the Professor's account of the Fellowes Furnace which had been developed in America for central heating and could be used for domestic purposes with a consumption of fuel at the rate of $1\frac{1}{2}$ lbs. per hour. Professor Thring's address was followed by a lively discussion.

The **South Wales and Monmouthshire Division** held its Annual General Meeting on 8th December, 1955, at Cardiff. Mr. F. J. Redstone, the National Chairman, was present, and was cordially welcomed by the Divisional Chairman, Ald. Dr. C. A. Bence. The Officers and Divisional Council for 1956 were elected, the officers remaining the same as in 1955. A report was submitted of the Annual Meeting and Conference of the Society at Bournemouth, and a progress report on the Clean Air Bill.

A meeting of the newly formed Divisional Executive followed. It was resolved to form a Sub-Committee to arrange a programme of activities and suggestions made by Mr. Redstone were greatly appreciated. The Executive are of the opinion that an effort should be made to increase the membership, both of Corporate and Local Authority Members and that the appeal should come direct from Headquarters.

The **North East Division** held its annual meeting in Newcastle upon Tyne on Friday, 3rd February, 1956. In the absence of the Chairman, Councillor J. A. Brown of Middlesbrough was appointed to preside. The Honorary Secretary, Mr. G. W. Tate, reported on the discussions which the Hon. Treasurer and he had had with the District Auditor on the subject of meetings, and suggested that as a result of the views now expressed, that the formation of a North East Divisional Advisory Committe of Local Authorities, with the one meeting per annum allowed to the Society, would enable the North East to make a consistent attack on air pollution, which at present was not possible.

The Chairman outlined the activities of the Teeside Committee of Local Authorities, and expressed the view that there was room for three such committees to operate in the region, which in itself was too large, with differing problems on each of the rivers. After discussion, and some criticism, Alderman P. S. Hancock proposed, and Alderman N. Garrow seconded, that "This annual meeting of the North East Divisional Council of the National Smoke Abatement Society recommends the formation of a North East Divisional Advisory Committee of Local Authorities for Smoke Abatement." This was carried by an overwhelming majority.

The report of the Hon. Treasurer, Mr. W. Grey, was approved, and it was agreed that the thanks of the Division be recorded to him and to Mr. Tate for their past services. Mr. Tate intimated that he did not seek re-election as Hon. Secretary, but eventually agreed to carry on until the next meeting in July, when the Officers would be appointed for next year. Alderman J. Chapman M.B.E., was re-elected Chairman, and Mr. G. W. Tate and Councillor J. A. Brown appointed Vice-Chairman. Mr. Gray was re-elected Hon. Treasurer and the Executive Committee was re-appointed.

A report on the work of the national Executive Council was given by Mr. Isaac, for which he was thanked. The afternoon session was devoted to a discussion on the Clean Air Bill, which was opened by Mr. Arthur Blenkinsop, M.P.

SMOKE REDUCTION AND FUEL EFFICIENCY BY MEASUREMENT AND CONTROL*

By

Rear Admiral Sir Sidney Frew

K.B.E., C.B., M.Inst.F., M.Inst.Mar.E. (*Ministry of Fuel and Power*)

It is said that measurement is the essence of all factory economy.

Measurement is, in my opinion, the first step in any works campaign of fuel economy, and improvement in any direction can be achieved only by recording the existing conditions and studying them against a theoretical yardstick, while the automatic control of almost any process is not only more certain and more dependable than manual control, but also bound to effect improvement in thermal economy.

Adequate instrumentation, proper recording and the use of automatic controls, wherever practicable, are essential to the maintenance of high efficiency and lead to considerable economy in fuel and power both in the boiler house and in the factory, and also to smoke reduction.

The applications of instrumentation have in the post-war years been considerably expanded so that now they cover a very wide field. Unfortunately, however, there is still a widespread impression that the assessment of the efficiency of a boiler plant involves the use of expensive instruments, a vast knowledge of chemistry and a number of elaborate calculations.

Major industrial concerns having installations consuming large quantities of fuel, are, generally speaking, fully aware of the necessity for the utmost economy in the use of fuel. Economy does not mean restricting output but obtaining the maximum amount of energy from every ton of fuel consumed. The cost of an additional fraction of a one per cent. increase in consumption for a given output is so great that these large concerns recognize that the employment of specialists in plant operation and the extensive use of instruments is sound practice. The modern power station, for example, has a most imposing array of instruments and control equipment giving immediate and complete information on prevailing conditions and this equipment is rendered necessary by circumstances peculiar to the power station. Here the load may be doubled or trebled in a matter of minutes and with the large scale operational cycle being critical, any derangement can have serious consequences. The greater the plant sensitivity, the greater the need for rapid diagnosis.

At the other extreme there are the plants equipped with only those instruments that the law demands and many are operated without regard to the efficiency of steam generation. If

* A Paper read at the joint conference of the Combustion Engineering Association and the British Industrial Measuring and Control Apparatus Manufacturers' Association, London, July, 1955.

the efficiency is not measured it can hardly be controlled.

There can be no improvement without comparison.

There can be no comparison without measurement.

There can be no measurement without instruments.

Even a one foot rule is an instrument used to compare one length with another.

All boiler plants, no matter how small should be equipped permanently with such instruments as to indicate that the plants are being operated as efficiently as possible. The instruments should be of sound and simple design, accurate and should require the minimum maintenance.

The choice of the type of instruments most suitable is determined to a certain extent by the size and layout of the plant, but they should include a feed water or steam flow meter, means of determining the quantity of fuel burned, draught gauges, CO indicator or recorder, thermometers, pyrometers and a smoke density indicator and/or recorder. Indicators are of great assistance to the operating staff, but of little use to supervisors who are locally absent from time to time. Recorders not only give an instantaneous reading but provide a permanent record of performance.

About one third of the nation's coal is consumed in small industrial boiler plants where the Lancashire or Economic boiler is most commonly used. There are other types of small boilers, but it can be fairly said that any of them can only be operated efficiently under varying conditions of load if they are equipped with instruments which give certain essential information to the operating staff.

It is estimated that about 90,000 Shell type boilers are in use in the United Kingdom, of which only about a half are thought as yet to be equipped with mechanical firing. The provision of suitable equipment must be reinforced by an appreciation of the way in which it can be used to achieve the greatest possible economy in fuel. Although the fuel consumed by many industrial concerns represents a small proportion of the cost of the end product, it is in the national interest as well as that of the individual firm that fuel consumption is reduced to a minimum.

Instrumentation has a fundamental part to play in bringing this about and it is important, therefore, that:—

(*a*) Boiler plants and heat distributing services are correctly instrumented.

(*b*) Management should see to it that plant personnel fully understand the use of the instruments, not only as regards the method of operation but more particularly the way the instruments can provide the means of securing maximum efficiency and the greatest fuel saving.

(*c*) The instruments are located in a readily accessible position, preferably on a central panel, and are maintained in an accurate working condition.

A boiler plant that is in reasonably good condition can be operated at low efficiency if the combustion conditions are not carefully controlled. Unless the amount of air required for combustion is carefully correlated to the quantity of fuel being burnt, losses in the flue gases which account for the greatest waste in boiler plant can greatly exceed the minimum working level.

Investigations have shown that with deterioration in CO_2 from 14 per cent. to 9 per cent. due to excess air there would be an increase of 28 per cent. in fuel consumption per pound of steam produced in a Lancashire boiler without an economiser; 15 per cent. in a Lancashire boiler with an economiser and 7 per cent. in an Economic boiler.

It is important therefore that the right amount of air to ensure not only complete combustion but also to eliminate surplus air should be provided.

Instruments for indicating and/or

recording CO_2, CO + H_2 and flue gas temperature are consequently of the greatest help to the plant operating personnel to enable them to achieve the correct fuel/air ratio in boiler units, particularly when it is borne in mind that the majority of the small Shell type boiler plants have to deal with variable industrial processing and power loads.

Where the steam flow required is subject to appreciable fluctuation the provision of a steam flow meter enables the operator immediately to see when the load is increasing or decreasing and to make the requisite adjustments. This can reduce the necessity for large alterations in the firing rate to restore the boiler pressure to normal. It is not always appreciated that when the steam pressure steeply falls, the heat efficiency of every steam consumer is adversely affected. When the storage limit of a system is exceeded by a sustained load change and the steam pressure is seriously varied, forced firing or " blowing off " may result from delayed attention to the firing rate. A knowledge of the load and total quantity of steam supplied from individual and banks of boilers provides valuable information on the efficiency of their relative performance and boiler condition.

In considering the instrumentation of small boiler plants the importance of measuring the boiler output should not be omitted. Boiler output can be measured from the actual steam output or from the input of feed water. The basic requirement is the net production of steam, i.e., the net steam flow to the plant after deducting the steam taken by the boiler auxiliaries. A steam flow meter will give this directly if the auxiliary supplies are taken off before the meter. If a water meter is used, the auxiliary supplies must be estimated and an allowance made for the " blow-down." Meters of the differential type are likely to be affected by deposits and so the choice of meter depends, to some extent, on the cleanliness of the feed water or of the steam.

Measurement of the coal used is fundamental and the more accurately it is done the greater the confidence in any efficiency calculations. The direct method of actually weighing the coal may be used or the volumetric measurement correlated to the actual weight per cubic foot of coal may be the indirect method employed. The means adopted for the measurement of coal depends largely on the output of the boiler plant, the quantities of coal consumed and the characteristics of the coal handling equipment. Although smaller boiler plants are less likely to be equipped with coal measuring facilities, efficiency tests should always be based on measured coal.

The practical measurement of all fuels is by volume. It is true that a certain volume does not always represent a definite quantity of heat units, but to control accurately the amount of heat units supplied, particularly with solid fuels, would require apparatus of too complicated a nature. Fortunately, the variations in heat units supplied by a certain volume of any fuel are such that their influence on the accuracy of the control can be overlooked. Most systems embody means for manual or automatic adjustment of the fuel volume when a change in calorific value is known to have taken place.

For fuels burnt in suspension, a control system has been developed which uses the boiler as a calorimeter and enables, to a large extent, compensation to be made for variations in calorific value.

To measure a fuel, it can be fed at a constant rate through a variable opening or at a variable rate through a constant opening. Both these methods are widely used on the stoker fired and pulverized fuel-fired boilers.

Stokers of the chain grate type have a gate which can be adjusted, and the quantity of fuel at constant stoker speed varies with the height of the opening between the grate and the gate.

Speed control is therefore adopted in all cases and this can be obtained

by regulation of a variable speed motor, constant speed motor coupled by a variable speed gear, or by other suitable variable speed drive.

For liquid fuels the opening of a valve is usually regulated and this gives proportionate control when the initial fuel pressure is constant. If fluid pressure varies, an adjustment of the valve opening in relation to fluid pressure is necessary.

For gaseous fuels measurement by means of an orifice plate is generally to be recommended, unless the gas pressure is constant, when damper position regulation alone is sufficiently accurate.

In general it may be said that instrumentation will effect a saving in fuel consumption of the order of 10 per cent. and consequently make an appreciable contribution to a reduction in air pollution from smoke and grit.

The density of smoke passing through a boiler flue can be observed and measured accurately by means of an automatic smoke recording instrument. The method of continuous measurement and recording of smoke density is one in which measurement is made of the amount of light obscured by the smoke when a beam of light is shone through the smoke in a flue. Such instruments can be fitted with audible and/or visible alarms which operate when the smoke is above a predetermined density. It is important that these smoke density meters should be installed in accordance with the manufacturers' instructions and be sited in readily accessible positions to facilitate the routine cleaning of the observation glasses by the boiler plant operators and also the periodical adjustment and checking of the instrument settings.

Automatic Control

When coal was cheap and plentiful, automatic boiler control was, at its inception, regarded by many as unnecessary. Management considered it to be a gadget and its advantages doubtful, whereas the operators were concerned at the possibility of their services being replaced by automatic boiler operators. The war and post-war conditions brought about a new set of factors which have changed even the hardest sceptics. Dearer coal of varying quality and the need for its conservation, coupled with ever increasing complications in size and design of boiler plant and auxiliaries and the shortage of skilled operating staff, have resulted in a change of thought. Now automatic control is considered by most as a necessary adjunct to instrumentation for the safe, easy operation of boiler plant, coupled with maximum efficiency.

The object of automatic control is to regulate automatically the heat input to a boiler in terms of fuel and air supplies in relation to heat output or steam demand. Such automatic control gives better and more efficient operation, a saving in fuel and often in labour, and increased safety.

Better operation means an increase in efficiency in steam using plant as a result of more constant steam pressure and steam temperature. It avoids unduly high gas temperatures and large temperature changes in sections of the boiler other than in the combustion chamber. It gives a longer life to the boiler walls and consequently reduces maintenance. It gives better load distribution and, if desired, the output can be shared in proportion between the boilers. It provides for a reduction in smoke and grit emission and permits of longer steaming periods between plant overhauls.

It is seldom that a boiler plant is encountered where automatic operation cannot be recommended from a technical as well as a financial point of view.

Generally, the maintenance of optimum combustion efficiency resulting from the use of automatic control enables appreciable fuel savings to be obtained as compared with manual control. Such savings are usually 3 per cent. or more for an industrial plant. Centralized control enables immediate correction or action to be

taken in the event of an emergency, with a smaller possibility of operational errors occurring.

Automatic control is labour saving in that banks of boilers can be controlled at a central point by less men. It is not the main object of automatic control to save labour to the extent that it can be dispensed with almost entirely, but it is possible to do this for short periods in an emergency.

The real purpose of automatic boiler control is to balance heat input against heat output and not as is sometimes supposed to maintain a constant steam pressure, as normally fuel saving is of primary importance. Indeed, the steam pressure is deliberately allowed to vary in certain plants.

Also it is not necessarily a requirement that constant combustion chamber suction should be maintained under all conditions, as it is sometimes desirable that the draught be increased with the load. The measurement and control of furnace suction is a means of maintaining the equilibrium between forced and induced draught and either of these is adjusted in a control system to the load. In most control systems the gas flow is measured in terms of the draught loss across the boiler or the economiser and this should provide an indication of the actual air flow.

The measurement of CO_2 is an important part of the work automatic control is designed to do and frequent changes in readings are an indication that there is a variation in fuel quality or that the control equipment is not functioning correctly due to a fault. Correct CO_2 readings are, of course, of great importance.

The measurement of boiler output with modern control systems and even distribution of the load in the units of a boiler group are obtained by the air, fuel and draught being properly controlled, but there are occasions when an uneven distribution is called for. The control system should therefore embody means for an accurate resetting of the share taken up by the various boiler units.

Instrumentation serves all industries, atomic energy, coal, gas, electricity, chemicals, water supplies and manufacturing processes. A large number of schools are also being equipped with solid fuel space heating installations complete with fully automatic control.

With the many new and complicated processes of today and the need for greater output, greater accuracy, greater economy in manpower and of materials—particularly the nation's fuel supplies—and for cleaner air to breathe, the use of instrumentation and automatic control is of fundamental importance.

NEW FILMS FOR FUEL EFFICIENCY TRAINING

The National Industrial Fuel Efficiency Service is preparing a series of training films, intended to supplement courses for boilerhouse operators, the first two of which were recently shown in London. The first is " You and Your Fuel," and is a straightforward, practical demonstration of the path of coal from the coal face to the boiler furnace, with explanations of the factors that cause its quality to vary—dirt and water, the volatile matter, coking behaviour, and ash. In simple terms the testing and classifying of coal is shown, and in general the film gives a picture of the fuel that cannot but help the boilerman to understand it and to deal with it more efficiently.

The second film, " Burning Your Fuel " shows, again in a simplified way, the reasons for heat in coal being lost, and demonstrating, in actual practice, how these losses can be reduced. The main factors are given as ashpit losses, smoke and grit losses, flue gas losses, and—although the stoker can perhaps do little himself to remedy it—the losses due to radiation from the shell of the boiler and its brick settings. Firing methods, damper control, the watching of the

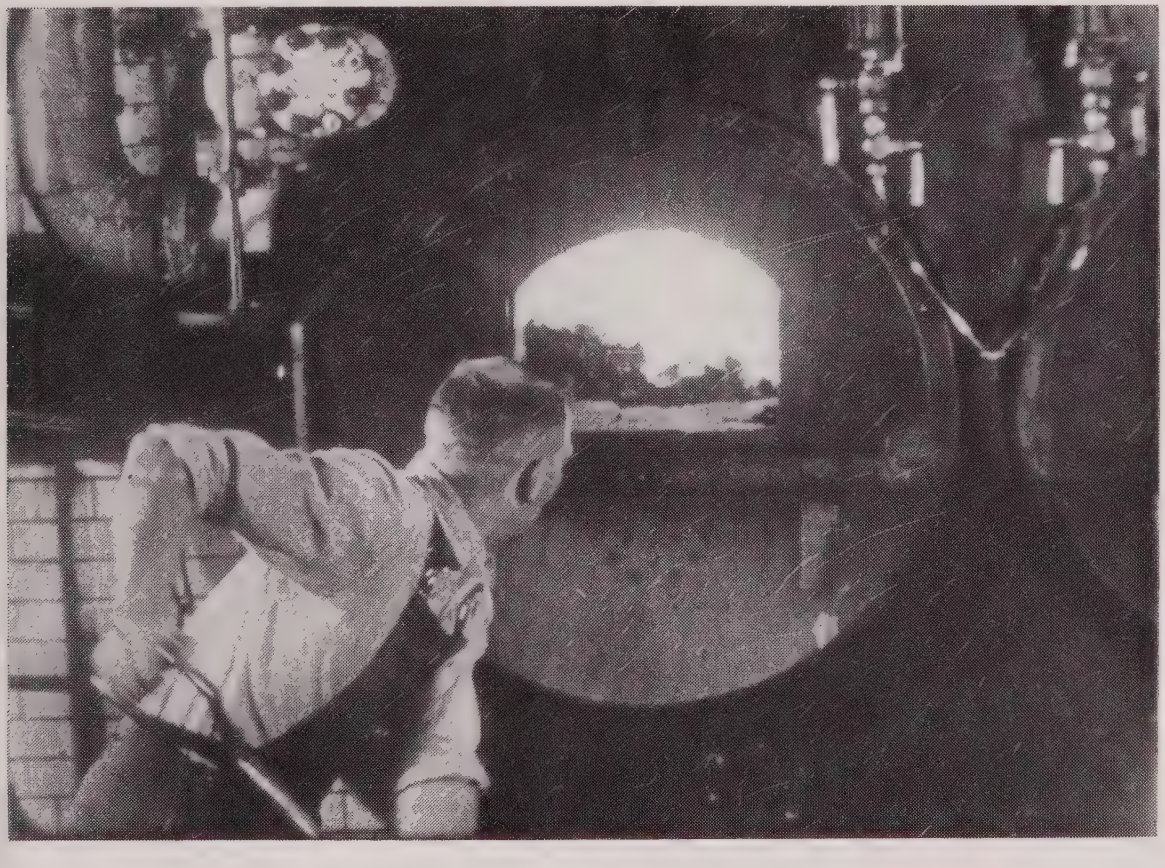
draught gauge, increasing secondary air on firing, and other practical hints are dealt with clearly and persuasively. Both of these films are concerned with hand-fired boilers.

The quality of the films and of the spoken commentary is excellent. They seek only to bring before the men the basic principles of combustion in a form that can be readily understood, and because of this special purpose may not be entirely suitable for general showing outside the Boiler Operators' Certificate course. Nevertheless, say N.I.F.E.S., " should it be felt that they can be of use to other bodies, and provided a careful explanation of their function is given before the showing of them, the Company would be pleased to arrange to loan copies."

N.I.F.E.S. has also produced a useful film strip in colour on the subject of " Small Heating Systems." With 36 frames, it illustrates by diagrams and photographs, a lecture on which notes can be supplied. Information about this and about the films described above may be obtained from N.I.F.E.S. head office at 71 Grosvenor St., London, W.1., or from any N.I.F.E.S. area office.

New Gas Films

The Gas Council is producing a series of 14 films describing gas manufacture, distribution and utilization. A selection of the first of these was shown recently, and was appreciated for their technical quality and the clarity of their exposition. For schools and training courses of many kinds these films will be found to be most useful, while those in the series of a more general nature—such as the introductory film of the series, " Gas in Everyday Life "—will be found to be of value for more general audiences. As a further section of the industry's new " complete visual education unit " there have also been produced several film strips, as well as wall charts and teaching notes needed to accompany the films and film strips and to explain their use. Each of the films is complete in itself.



A still from " You and Your Fuel "

THE DENSITY OF WASHED PLUMES FROM POWER STATIONS

By

G. Nonhebel

In his article on " An Effect of Gas Washing at Battersea Power Station " in SMOKELESS AIR No. 95, Autumn 1955, Dr. Scorer makes statements and deductions which he then uses as a general criticism of processes of washing flue gases for the removal of sulphur dioxide. Further, the photographs, which admirably support the case Dr. Scorer is endeavouring to establish, are not representative of the general conditions existing at Battersea.

The Battersea plant was designed over 20 years ago and there have been many improvements in chemical engineering since then. It is now undergoing extensive overhaul. The efficiency of the gas washing plant in 1954 was 83 per cent compared with 97 per cent for the modern plant at Bankside using the same process (data from Annual Report on Alkali Works, etc, 1954).

In these two plants the gases are washed with cold river water which after neutralization and oxidation is then returned to the river. The gases are cooled nearly to river water temperature and will therefore have no thermal rise. Dr. Scorer states that the gases contain a substantial mass of water droplets when they emerge from the top of the chimney. It is true that some water mist is formed in the upper part of the washing tower because the gases entering the bottom of the tower are quickly cooled to the wet bulb temperature and are somewhat more slowly saturated with water vapour. The saturated gases are then cooled further in the upper part of the tower and consequently give up moisture, forming a mist. This mist will, however, quickly aggregate into droplets in exactly the same way as does the mist inside the upper part of a large concrete cooling tower, and in any well designed scrubbing system nearly all the moisture will be collected by the scrubbing surfaces and spray eliminators. There is, in fact, no evidence that liquid droplets escape from the chimneys of Battersea or Bankside in sufficient quantity to give the type of drizzle observed round old water cooling towers. The actual mist content in the gases at their point of emergence from the chimney will be about $0{\cdot}5^3$ gm/m at 20°*. This is negligible compared with the density of the flue gas which is about 1,249 gm/m³ saturated at 20°C assuming a CO content of 12 per cent. The density of air is 1,247 gm/m³ at 10°C, the average temperature. The flue gas is therefore likely to be just heavier than the air around the top of the chimney and will therefore have a tendency to fall. The equivalent density of the flue gas will also be enhanced by the cooling arising from evaporation of the mist into the air which rapidly dilutes the plume as soon as it leaves the chimney. The effect is not, however, large, being equivalent to a lowering of temperature of 1°C.

It will be seen from the above that Dr. Scorer is incorrect in deducing that the plumes from gas washing plants using a once-through water

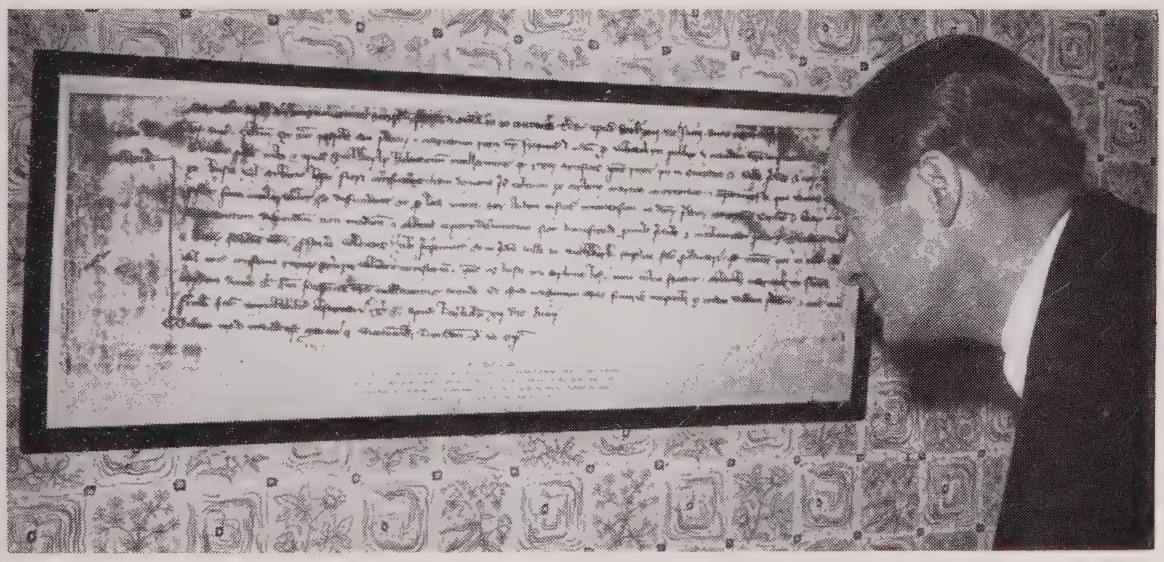
* " Drizzle precipitation from cooling towers," A. Blum, *Engineer*, 6th August, 1948, page 128.

system are *much* heavier than air and will therefore always have a tendency to fall. In practice they only dip downwards occasionally according to my own frequent observations. This is partly because the gases are discharged with appreciable velocity and partly because there are frequently upward currents of air past the chimneys.

Future gas washing plants are likely to employ a system of washing in which the water is recirculated, as in the process used at Fulham before the war with 97 per cent removal efficiency and as will be used in the C.E.A. prototype plant in which ammonia is to be used as the neutralizing agent and saleable sulphate of ammonia produced. In these recirculating systems, the flue gases are cooled only to their wet bulb temperature 48°C and no mist will be formed in the scrubber, but the gases are saturated with water vapour. In such circumstances, the density of the saturated flue gas at 48°C will be 1,110 gm/m³, compared with a density of 1,247 for air at 10°C. The washed gas is therefore appreciably less dense than the surrounding air, though it has not, of course, as low a density as unwashed gas at 150°C, namely 835 gm/m³.

The above figures have been calculated using a particular coal analysis and will vary slightly from coal to coal. It has been necessary to quote detailed figures in order to substantiate the arguments.

The cooling of the warm saturated gases as they pass up the chimney is negligible, but as soon as they mix with the outside air, they are cooled and mist is formed, though because of the latent heat of condensation, the mixture of air and gases is at a higher temperature than if no mist were formed. After travelling about $\frac{1}{2}$ mile, sufficient air mixes with the misty plume to evaporate the initially formed mist and the mixture is then cooled by the equivalent of the heat originally liberated by the condensation of the mist. The temperature drop, however, is small as by then the plume consists of a mixture of flue gases with many times their volume of air.



Mr. Sandys Looks at the First Clean Air Law

The Minister of Housing and Local Government, the Rt. Hon. Duncan Sandys, M.P., who is in charge of the Clean Air Bill, examines a photograph of the earliest clean air legislation—the ordinance of 1307. This interesting exhibit, which usually adorns the Society's Committee room, was lent to the Solid Smokeless Fuels Federation for their recent "Clean Air and Fuel Efficiency" Exhibition at Charing Cross Underground Station, opened by the Minister on 30th January.

1956 FUEL ECONOMY REVIEW

The 1956 edition of this Review, published by the Federation of British Industries, again contains a great deal of matter which has a direct bearing on smoke abatement. One article, entitled " Combustion Efficiency, Gas Analysers and Atmospheric Pollution," is of particular interest.

The author, J. C. Farquhar, B.SC., A.R.I.C., sets out the case for using a form of continuous oxygen analyser, in conjunction with a smoke indicator, for obtaining the optimum combustion conditions in industrial furnaces. He points out that the concept " excess air " applies to the amount of air above that theoretically required to burn all the combustible elements in the fuel used. This means that a minimum quantity of excess air must always be used under practical furnace conditions, if sufficient oxygen is to be supplied to make sure that all the fuel is fully burnt. This, plus the amount theoretically necessary, he calls " adequate total air."

From this, he challenges the value of measuring the CO_2 content of the flue gases, as a criterion of correct air supply. For, he points out, it has two serious limitations:

> " Firstly, under equal conditions of complete combustion and excess air, the CO_2 content of the flue gases will vary with alterations in the carbon/hydrogen ratio of the fuel. Secondly, if combustion is incomplete due to the provision of inadequate total air, some of the oxygen will be used up to produce CO, and the CO_2 content will be correspondingly reduced, thus falsely suggesting that too much air is being supplied."

He then goes on to say:

> " For furnaces either under manual or automatic combustion control, some instrument will be needed to check whether the correct total air is being supplied. It has been suggested that a smoke indicator should be used for this purpose, but at best, a smoke indicator can only tell when too little air is being supplied. It cannot indicate when, or by how much, excessive air is passing through the furnace. To attempt to run a furnace on a continuous indication of slight smoke is to attempt to balance on the borderline of inadequate air. This is bound to lead to inefficient combustion and an increase in atmospheric pollution. Furthermore, smoke indicators are useless when smokeless fuels are used. The smoke indicator is therefore not satisfactory to measure whether adequate total air is being supplied and its readings are not sufficiently qualitative for it to be made the basis for manual or automatic air control. It finds its true application as a warning for bad combustion conditions . . ."

The fundamental measure of correct total air supply is residual oxygen concentration. Therefore, the author argues, the ideal instrument for air control is a continuous analyser for oxygen in flue gas. He then describes an ingenious instrument based on a " magnetic wind " principle, which uses the reaction of oxygen to a magnetic field to give a continuous reading of oxygen present in flue gases.

The best arrangement is then an oxygen analyser combined with a smoke indicator; the smoke indicator is used purely as a warning that something is wrong, while the oxygen analyser provides a constant check on, or control over, the fuel/air ratio. The main advantage from the smoke abatement point of view would seem to be the check which can be kept to see that apparent smokelessness is not in fact a result of dilution of the stack gases by excess air.

CLEAN AIR EXHIBITION AT STEVENAGE

An interesting exhibition was held in Stevenage from 18th to 21st January, under the auspices of Stevenage Urban District Council, organized by the Chief Sanitary Inspector, Mr. R. V. Lamey, and supported by the Stevenage Development Corporation. Councillor F. G. Newberry spoke on behalf of the Council and welcomed Sir Hugh Beaver, who opened the Exhibition. In his speech, Sir Hugh pointed out that Stevenage was the first " new town " to hold such an exhibition, and this was therefore an important step along the road to clean air. He had no doubt that the Clean Air Bill, perhaps with some modification, would go through Parliament, but it was important to remember that the whole question of air pollution was one of great urgency. He thought it essential that everyone keep in mind the final objective of a clean air policy —the reduction by at least 80 per cent. of the amount of smoke in Britain's atmosphere. Sir Hugh said that smoke was probably the major villain, and no local authority should be deflected by those who said that the removal of smoke was only half the problem. Sulphur in the air was a danger, but the medical opinion collected by his committee had shown that it was probable that the combination of smoke and gaseous pollution was far more dangerous than the gaseous pollution itself, because the smoke gave the sulphur gases a centre around which they could coagulate. The result was a sulphur-impregnated particle which, when inhaled, stuck to the walls of the lungs.

Sir Roydon Dash, Chairman of the Stevenage Development Corporation, moving the vote of thanks, explained that all houses built in the new town



New Houses at Stevenage

were fitted with appliances designed to burn smokeless fuels, while most of the factories were oil-fired or burned smokeless fuels. It was hoped that the proposed town centre would be a smokeless zone, in which offices, shops and flats would be heated from two central oil-fired boiler-houses. Mr. Martin Maddan, Member of Parliament for the Hitchin Division, stressed that less smoke meant less dusting and washing for the housewife, and therefore a raising of living standards. He said that Stevenage intended to show that, although the popular North country phrase was " Where there's muck there's money," it was possible to have money without the muck!

Among the exhibits were a model atomic power plant, electrical cooking equipment shown by the Eastern Electricity Board, gas heating appliances shown by the Eastern Gas Board, a model of the Town Centre and an excellent display of photographs, loaned by the Development Corporation. The Guinness Festival Clock, borrowed for the occasion and placed on the village green, near the Town Hall, gave an air of gaiety to the proceedings.

The interest in clean air, and the energy and foresight shown by the authorities in Stevenage to ensure that theirs is a " clean town," could well be emulated by those responsible for the development and administration of many old—and new—towns.

Domestic Heating Conference

We can now give more details of the opening conference of the Institute of Fuel's " Special Study of Domestic Heating in the United Kingdom—Present and Future," which is to be held at Church House, Westminster, on 1st and 2nd May, 1956.

A considerable number of other organisations, including the N.S.A.S., are included among the participating bodies. Members of the Society desiring to attend will be able to do so on payment of a reduced conference fee of half a guinea.

The conference will take the form of five sessions, as follows: Fuels; Appliances—their Design and Application; Design of Dwellings; the Planning and Adminstration of Smoke Control Areas; and, finally, a summing up by a general rapporteur, followed by a discussion of the whole subject of the conference. There will be, in all, about 45 individual papers.

The first session is to be opened by the Parliamentary Secretary to the Minister of Fuel and Power, and the second by the Parliamentary Secretary to the Minister of Housing and Local Government.

In connection with the special study the Institute is also holding an open competition for the design of settings for free-standing domestic fires. There are three sections, in each of which a prize of 200 guineas is offered—for new low-cost dwellings, for new dwellings that are not so limited in cost, and for the conversion of existing dwellings.

Full details of the conference and of the competition may be obtained from the Institute of Fuel, 18 Devonshire Street, London, W.1.

City " No Smoke " Plan in Ten Years

Birmingham established as one complete smokeless area within ten years is the " broad basis " on which the Birmingham Health Committee hope to proceed, states the report which the committee has presented to the City Council.

Recalling that the city centre and an area at Garrett's Green will become smokeless zones on July 1st, the report says the discussions with representatives of fuel distributors in the city have taken place to ensure adequate supplies of smokeless fuel when additional smokeless areas are created.

AIR POLLUTION FROM STEEL PLANTS

A New American Ordinance

The Smoke Control Ordinance of Alleghany County, U.S.A., as amended in July 1955, reveals a determined effort to control air pollution from steel plant where this is practical, and to force the industry to carry out research into allied problems.

Those steel and allied processes specifically mentioned in the ordinance, are exempt from the general article of the ordinance which prohibits smoke in excess of No. 2 Ringlemann Chart (referred to hereafter as No. 2 R.C.) The following is a summary of the requirements of the ordinance in respect of the steel and allied processes.

Blast Furnaces: Must be fitted with gas cleaning devices to reduce the fly ash of gases discharged to atmosphere to not more than 0·4 lb. per 1,000 lbs. of gases. Where unburnt excess gases are emitted, the limit is raised to 0·5 lb. These limits do not apply during slips; but plants must be equipped with devices to record graphically the time and duration of slips, and these records must be produced on demand.

Coke ovens: When coal is being charged, or coke is being pushed, smoke in excess of No. 2 R.C. is permitted for not more than 15 minutes in any 60 minutes. Leakage from doors is restricted to not higher than No. 2 R.C.

Open hearth furnaces: The plant must incorporate such pollution control equipment which has been " found to be economically practical."

Heating and reheating furnaces: Smoke in excess of No. 2 R.C. permitted for not more than 6 minutes in any 60 minutes; and not more than 12 minutes if shown that smoke is essential to the process. Maximum fly ash permitted is 0·3 lb. per 1,000 lbs. gases. All furnaces requiring smoke for process and all furnaces using solid fuel, must be reported annually to the Bureau of Smoke Prevention (B. of S.P.).

Puddling furnaces: Smoke exceeding No. 2 R.C. permitted for not more than 15 minutes in any 60 minutes, and maximum fly ash permitted is 0·5 lb. per 1,000 lbs. gases. All furnaces using solid fuel to be reported annually to the B. of S. P.

Sintering: Plant to incorporate pollution control equipment found to be economically practical.

Cupolas: Maximum fly ash permitted is 0·5 lbs. per 1,000 lbs. gases.

Air furnaces: Smoke exceeding No. 2 R.C. permitted for not more than 6 minutes in any 60 minutes; and maximum fly ash is 0·5 lb. per 1,000 lbs. gases.

Non-ferrous foundries: Plant to incorporate pollution equipment found to be economically practical.

Additional requirements

In addition to the above, the operators of the processes mentioned below must:

(*a*) undertake or participate in a programme of research to determine practical methods of controlling emissions from the particular process; and

(*b*) report annually to the B. of S. P. indicating the progress of the research programme.

The processes named are blast furnaces, coke ovens, open hearth furnaces, Bessemer Converters, electric furnaces, and non-ferrous foundries.

Comment

Steel and allied plant are not given blanket exemption from air pollution

—To foot of next page



From our Photo-Library, No. 24

BLACK AREA

COALITE DEVELOPMENT

Coalite and Chemical Products, Ltd., of Bolsover, are planning an expansion scheme which it is estimated will cost nearly one million pounds and is designed to meet the requirements of the Government's clean air legislation.

The Company hopes to be producing half a million tons of smokeless fuel a year by the end of 1956. Mr. Francis Waring, the managing director, said last November that six new batteries of retorts were to be built to raise production from its present level of over 160,000 tons a year. Extra building staff had already been engaged to cope with the expansion programme and the total staff employed by the firm now amounted to between 850 and 900, of whom 700 were hourly paid workers mostly employed on the production of fuel and chemical by-products. It was possible that later even more staff would have to be employed. Already a considerable number of Italians worked at the plant.

Air Pollution from Steel Plants

—concluded

other than the general smoke control, but even as regards smoke, some control is exercised. Whether or not the gas is used, grit emission from blast furnaces is controlled, except during slips. The recording of the time and duration of slips will be of value.

The compulsory need to undertake or participate in control research and for the submission of annual reports might well be included in our new Clean Air Bill, as only the industry can solve the problems and should be encouraged to do so.

NEWS

Smoke Pollution Menace to Pennine Soil Fertility

Five hundredweights of soot fall every year on every acre of the Ministry of Agriculture's Experimental Husbandry Farm at Great House, Rossendale, on the Lancashire slopes of the Pennines—72 tons in the 12 months on the 350 acres of the farm. The daily records taken at the farm show that smoke in suspension and sulphur dioxide pollution of the atmosphere are 10 times those normal to a country district.

This appalling pollution from the neighbouring towns, plus the continuous washing out of calcium and nutrient salts from the soil by the excessive rainfall (55 in. average at Great House and 75 in. in 1954) constitute together a very grave handicap to the maintenance of soil fertility and production from grassland on the farms of the industrialized Pennines. Hence, work on grasses resistant to smoke pollution, and on problems of lime and fertilizer application, looms large in the experimental programme at Great House.

The deleterious effect of the smoke pall is two-fold: it directly inhibits the growth of grasses, while the sulphur dioxide content tends to aggravate a calcium deficiency which already requires continual correction owing to the leaching effects of the heavy rains. With regard to grasses, many of the species and strains which are proving so valuable to farmers in more favoured localities make poor growth and are short-lived in the Pennines. Thus of the pedigree rye grasses, even S.23, cannot be counted upon to persist for much more than a couple of years and the same thing applies to the cocksfoots. Many of the more highly productive and special-purpose grass seeds mixtures are ruled out.

Timothies and Meadow Fescues appear the most resistant to the soot and acid fumes. In an experiment at Great House eight types of seeds mixtures have been compared under four systems of management—mowing once and mowing twice each year, alternate mowing and grazing, and grazing only—and the mixture which has stood up best under all conditions is one of Timothy S.48, Meadow Fescue S.215, Cocksfoot S.143 with S.100 and S.184 white clovers. Now in its fifth year, this sward still looks satisfactory although the cocksfoot has tended to go.

St. Pancras Will Prosecute Again

At least two more "smoke nuisance" summonses are to be taken out by St. Pancras council against British Railways. The Council's decision to start more legal proceedings in its battle against smog has been taken in spite of the fact that the Clerkenwell magistrate, Mr. Frank Powell, recently dismissed other summonses brought by St. Pancras council officers which alleged smoke nuisance with engines at Camden Motive Power Depot, Chalk Farm. This time the summonses will be in the name of the council, and the proceedings are being taken under the Railway Clauses Consolidation Act, 1845.

The air pollution committee chairman, Cllr. P. Jonas, said: "We are determined as a council to go on and fight smog menace. Our policy is to work within the law and defend ourselves." Cllr. J. Lawrence, health committee chairman, said: "We have two cases in mind, one of smoke nuisance in Chalk Farm and another in King's Cross."

The air pollution committee are also making arrangements for a visit to the Midland Region installations of British Railways.

A committee representing all the London boroughs has agreed to back St. Marylebone, Hampstead and Paddington in a plea that smoke from railway engines should be included in the list of nuisances defined in the

Clean Air Bill now before Parliament.

Following letters being sent to the M.P.s in the three boroughs, asking them to support this view, the councils have sought and won the backing of the Metropolitan Boroughs Standing Joint Committee. The committee say that any exemptions in favour of railway engines should be curtailed and they have told the Minister of Housing and Local Government that the withdrawal of exemptions for railway engines will be sought.

Bristol Talks on Clean Air Bill

A special two-day course on air pollution, held recently at the Redland College, Bristol, was attended by nearly 100 industrial chemists, engineers and technologists. The course was arranged by the Department of Chemistry and Biology of the College of Technology, and was opened by Sir Hugh Beaver.

The first lecturer was Mr. I. R. Birkett, a Bristol solicitor, whose subject was, " The legal aspects of atmospheric pollution." He said it was thought that smoke from the ordinary hearth fire would not be dark enough to constitute an offence. " If, however, you damp your fire down with water and leave it all night, you may be for it," he added. He wondered how vigilant local sanitary authorities would be and how harsh justices would be in dealing with contraventions of the proposed Act. The Bill put forward a complete new outlook on the problem from a legal viewpoint, and Mr. Birkett said that there might be a spate of prosecutions.

Sir Hugh Beaver considered " problem " was far too kind and euphemistic a word for this air pollution. " It is a real evil and a curse," he asserted. Another speaker, Professor H. Heller, Professor of Pharmacology at Bristol University, stressed the need to deal with air pollution in the cities. Methods of measuring pollution were explained by Mr. E. G. Whittle, public analyst at Bristol. The film " Guilty Chimneys " was introduced by Mr. F. J. Redstone, Chairman of the N.S.A.S..

Electric Floor Heating

Stoke-on-Trent recently completed a scheme of sixty flats in two blocks for professional and semi-professional men and women living alone. In one of the blocks, known as Barker House, electric floor heating is installed. As described in the paper read at the Society's Conference by Mr. J. W. Moule, this form of heating consists of electrical elements laid in the concrete screed of the floors; this screed is heated by electrical elements at " off peak load " periods. The heat is retained for a considerable period after the electric current has been automatically switched off. Although this amenity is installed in each flat in Barker House, the tenants will have the option of taking advantage of the service. For those who do, there will be a charge of 5s. 9d. per week in addition to the basic rent of 28s. 6d. per week. Lighting, cooking, power, hot water and other heating, are all supplied by electricity.

A great deal of local interest has also been aroused by Crayford (Kent) Council's decision to use electric under-floor heating for their block of 71 flats at Erith Road.

Lectures on Atmospheric Pollution

A course of six lectures with the above title has been held at the Northampton Polytechnic, London, E.C.1. It has been organized by the Head of the Department of Applied Chemistry, Dr. Garside, and each lecture has dealt with a separate aspect of the problem, which was covered by a lecturer who is an authority in his chosen field. The titles and speakers are as follows: " The Nature and Causes of Atmospheric Pollution" by Dr. A. C. Monkhouse; " The Measurement of Atmospheric Pollution " by Dr. E. T. Wilkins; " Solid Smokeless Fuels " by Dr. G. E. Foxwell; " Liquid Fuels " by Mr. G. F. J. Murray; " Smoke Abatement from the Domestic Angle " by Mr. W. F. B. Shaw; " Smoke Abatement from the Industrial Angle " by Mr. G. H. Barnard.

£10,000 Saved in Three Years

In a paper to the Institute of Fuel in London on 7th March, Mr. I. S. Groundwater discussed "The Maintenance of High Efficiencies on Economic Boilers: a Record of Operating Experience."

In his paper the author described the measures adopted at one of the boiler stations in a Scottish factory where two double-pass Economic boilers were installed in 1939, to obtain continuous high operating efficiencies. These included reduction in the amount of secondary air, water treatment to keep the water side of the heat-transfer surfaces clean, shortening of the grates, and a change to a lower-volatile coal in the interests of smoke reduction. Further improvement was achieved by fitting baffles in the furnace tubes, and the overall result was a reduction of 52 per cent in the coal consumption of the plant. In approximately three years the total saving on the fuel bill at the plant was about £10,000. Full heat balances as measured by the plant engineers are given, and for comparison the results of independent boiler trials conducted by the National Industrial Fuel Efficiency Service are reported. Whereas formerly the thermal efficiency of the plant varied from 53 to 66 per cent, it is now between 80 and 87 per cent. It is estimated that if the same measures were applied to all shell boilers in this country it would not be long before annual coal savings would be achieved of the order of 17 million tons, enabling foreign exchange used for importing coal to be reduced from £80 million to £20 million per annum.

City is "Eating Up its Own Past"

Birmingham's smoke-laden air is seeping into the Reference Library's iron room and slowly eating up the past by destroying irreplaceable documents. The iron room's steel shutters and metal bookcases keep the records safe from fire, but through doors and windows the dust and fumes come in. Details of the library's staff battle with the dust, and of the damage done by industrial fumes are given in the annual report of the City Library committee.

"Birmingham is slowly eating up its own past," said the head of the Shelves Department, Mr. D. Goode. He and his staff of six are using science to combat the products of science—sulphur and industrial dust in the air. "Some damage may be accounted for by the prevailing winds. They blow in alkaline laden air from chemical works in the Oldbury area," he says. Two of his staff, Mr. H. Pargeter and Mr. S. Garbett, spend their time vacuum cleaning the 654,473 books in the reference department vaults, and the dust is so thick they have to wear breathing masks. Many of the books are priceless works printed before 1500. To repair an atmosphere-eaten volume may cost anything from £5 to £50.

Liverpool's First Smokeless Zone

Liverpool's first zone is to be introduced in two stages, concerning the first of which, it is hoped, an order may be brought into force not later than October, 1957. This stage is bounded by Chapel Street, Tithebarn Street, Hatton Garden, Manchester Street, Whitechapel, Lord Street, James Street and George's Parade. This is obviously an appropriate time to apply the provisions to such an area, where many new buildings are still to arise, in blitz replacements.

The corporation themselves will have to deal with a number of their own buildings within the affected areas. Survey already shows that, at certain premises, considerable difficulties will be encountered in converting installations to eliminate the smoke nuisance. Some will need extensive structural works, and costly central heating facilities. In Stage 1 there are fourteen corporation properties, and in Stage 2 there are six.



THE RECENT SMOGS

November

The winter of 1955-56 brought two smog episodes, the first of which, in the North West on November 17th and 18th, threatened to become of major seriousness. Fortunately, on the second day conditions were becoming patchy, and by the 19th only misty conditions were recorded. On the 17th the concentrations of smoke in Salford rose at one time to 4·67 mgm. per cubic metre, with an average of 2·67 mgm. Sulphur dioxide concentration several times exceeded the highest level recorded in the London smog of 1952, with a maximum reading of 1·582 parts per million and an average of 1·347. On the 18th the smoke concentration averaged 3·09, with a peak at noon of 5·16 mgm. The peak sulphur figure was again 1·582, but the average fell to 0·867 p.p.m. Full details were published in the *Lancet* of 26th November, 1956.

Casualties were less than had been feared. In Manchester 20 more people than usual died during the first two days of the fog from cardiac failure through acute bronchitis or asthma. Less than a dozen deaths in Salford were ascribed to the smog, but it was reported that morbidity was undoubtedly increased. One doctor said that 30 of his patients had to go to bed for rest and treatment and this was only " the part of the iceberg that showed." While there were few deaths there were, to quote the words of several practitioners, many " near misses."

In Liverpool the smoke content of the air increased during the fog by tenfold—from an average of 0·354 to 3·2 mgm. per c. metre.

On the economic side one store in

Photo: Outside Victoria Station in the January fog

Salford reported that goods worth £200 had been " lost " by damage in the smog, and many others reported losses of up to £20. It was reported that

> " The loss was most severe in those shops where there were no assistants, where shop windows were packed with exhibits and the occupiers had not time to take precautions. For instance, two ladies' and children's outfitters were seriously affected; the first, where the occupier was on her own and unable to clear the window, reported that it was not possible to estimate the loss by soiling, but it was serious. The occupier's condition in view of her loss and her inability to cope with it were pitiful. . . ."

January

The following report on the January 1956 fog, relating to the observations taken, has been issued by the Department of Scientific and Industrial Research:

During the fog which covered many parts of the country between 4th and 7th January, measurements of air pollution were organized by the Fuel Research Station of D.S.I.R. in London, Birmingham, Leeds, Manchester, Salford and Sheffield. Taking part in this work were more than five hundred volunteers including many from the Civil Defence Corps, who patrolled the streets day and night using special equipment. Many local authorities also assisted the investigation by making extra observations with apparatus installed for measurements throughout the year.

The results show that in these areas the concentrations of various pollutants varied considerably from hour to hour and from point to point, due to fluctuations in meteorological conditions and amounts of emissions from local chimneys. The concentrations of smoke and sulphur ranged from very small amounts to as much as two or three times the overall average figures for the period of the smog. In the London area the smoke content of the atmosphere averaged about 90 per cent and the sulphur dioxide content about 70 per cent of these recorded during the great smog of 1952, or three or four times the normal for that time of the year. In addition to the lower degree of pollution the recent smog was of considerably shorter duration than that of 1952.

The average amounts of smoke and sulphur dioxide in the air of the other towns were similar to those in London. In the smokeless zone of Manchester the measurements of smoke gave figures about one half of those for the surrounding area. Concentrations of carbon monoxide in the several towns were not much greater than those found in large towns under ordinary weather conditions.

The study of the thousands of results by the Fuel Research Station is still going on but it is already evident that the work of the volunteers, often carried out under unpleasant conditions, has provided valuable information which could not have been obtained in any other way.

POLLUTED AIR AND CANCER

Dr. W. C. Hueper, head of the environmental cancer section of the National Institute of Health, U.S.A., has published in the Government publication *Public Health Reports* an article on the causation of lung cancer. He allows cigarette smoking to have only a " possible contributory role," and maintains that the contaminated air of America's chief industrial cities is the principal cause of the disease. He states that experiments, statistics and exhaustive surveys all support the conclusion that " atmospheric pollutants are in great part responsible for the causation of cancer," and strongly urges that " rigid measures " be taken "to discourage the introduction of new cancer-causing chemicals into the air."

SMOKE PREVENTION ABSTRACTS

235. The Design and Performance of Modern Gas-cleaning Equipment. Stairmand, C. J. (J. Inst. F. **29,** 58). This paper reviews the main methods of large-scale dust collection, namely cyclones, electrostatic precipitators, fibre and fabric filters, and wet washers, including impingement scrubbers, disintegrators, spraytowers and venturi scrubbers. In each case a brief discussion of the probable mechanism of operation is given, with a practical " grade-efficiency " curve, obtained from accurate tests on installed plant. Finally, a method of economic assessment is described, showing how the collectors can be compared in terms of total operating costs, related to their collection efficiencies on a standard test dust. Two appendices are included. The first gives a worked example showing the method of predicting from the appropriate grade-efficiency curves the performance of a cyclone-electrostatic precipitator dedusting installation, and the second describes the I.C.I. standard apparatus and method for measuring the performance of gas-cleaning plant.

236. Steam and Power in the Gas and Coking Industry. Clark, L. J. (Inst. Fuel, London, 18 Jan. 1956). The considerations outlined in this paper show that the efficient utilization of steam and power has an important influence upon the overall efficiency of nearly all the processes employed on the gas and coking works. Although considerable progress has been made, a study of the conditions in most works indicates that by more complete electrification, integration of power and process steam loads, full waste-heat recovery and effective use of coke-breeze fuel, further substantial improvement can still be effected in nearly all cases where steam and power are used.

Whereas at the present time the fuel consumed under boilers on the average gasworks is equivalent to about 7 per cent. of the coal carbon-carbonized, it is possible by effective modernization to reduce the consumption of fuel substantially and, in works with continuous vertical retorts and c.w.g. plants, it may be eliminated entirely. If this could be achieved throughout the entire gas industry in Britain, an overall fuel saving amounting to more than 1 million tons per annum could be effected and the corresponding financial saving would be considerable.

At the present time the gas industry produces 75·7 therms of gas and coke for every 100 therms of coal consumed, and this compares with 23·4 therms of electricity per 100 therms of coal burnt under the boilers in the electricity supply industry. With complete modernization, the efficiency target for the gas industry should be 85 to 90 per cent., and if this is achieved it will place the gas industry in a strong competitive position.

237. Catalyst Mufflers Purify Engine Exhaust. (Design News, 1. Oct. 1955, 15). Designed for direct connection to exhaust manifolds of indoor petrol-engined industrial vehicles, catalytic mufflers are said to eliminate 90 per cent. of carbon monoxide fumes over a 600 hour operating period. The muffler units contain a number of of small chambers in a horizontal row, each holding beds of catalyst pellets, which oxidize gases to an odourless exhaust of carbon dioxide and water vapour. Devices of similar design are being tested for use on automobiles. (D.S.I.R.)

238. Equipment Embodying Plastic Candle Filters Removes Finest Dust Particles Down to 0·5 Micron. (Chemical Process., Lond., Oct. 1955, **1,** 7). The filters are made of a thermoplastic material in which the pore size has been controlled during manufacture. This material makes for a

lightweight filter. It has a very small pressure drop in use, and will retain dust particles down to 0·5. The standard candles have a uniform length of 1000 mm. and are made up in groups of 200 for filtering up to 3,000 cu.m/h. and to 1,600 for a capacity of 25,000 cu.m/h. The filter area of a group of 200 candles is 30 sq.m. (D.S.I.R.)

239. While Air Cleaning Efficiency Improves . . . Waste Heat Makes Power. Boulden, R. L., Carson, D. B. and Rosenblatt, J. D. (Industr. & Pwr. Aug. 1955, **69,** 46-50). Efficiency of electrostatic precipitators on the kilns was improved by reducing temperature and velocity of the gases by passing them through a waste heat boiler. (D.S.I.R.)

240. Why Tall Smoke Stacks Fail to End Air Pollution Woes in Houston Area. Resen, F. L. (Oil Gas. J., 3 Oct. 1955, **54,** 139). Six factors affect disposal of waste gases via stacks: stack height; gas velocity; gas temperature; wind velocity; land topography; and meteorology. The first three can be controlled and have least effect. As regards wind: light-to-moderate breezes produce thermal looping, breaking the plume into segments some of which drop to the ground with their heavy concentration of gases; prevailing winds continually direct the plumes into the same area; and local wind eddies caused by buildings, trees and water may cause serious downdraughts in a limited area. The absence of hills in the Gulf Coast means no natural updraught and causes the plumes to tend to roll along the ground and contaminate large areas. The unusual meteorology causes the most trouble; temperature inversion occurs about half the time and causes the plumes to spread out flat instead of rising and dispersing. These conditions all tend to nullify the effect of high stacks. Scrubbers, filters, cyclones, etc., must also be used in this area.

241. Theoretical and Experimental Investigations on Dust Distribution in a Smoke Stream. Pts II & III. Trappenburg, R. (Staub, 15 June 1955, **(40),** 189-220). Apparatus for measuring dust deposition comprises a plate of aluminium foil smeared with commercial vaseline. The plate is weighed, exposed to the air for from one to four days and then re-weighed, the difference being the weight of deposited dust. Corrections for temperature, wind, moisture, etc., and methods of calculation are discussed with tables of results and examples. (D.S.I.R.)

242. Decrease of Ultra-Violet Solar Radiation by City Smog Occurring in Winter. Miyake, Y., Saruhashi, K., and Sakurai, S., (Met. Abstr., June 1955, **6,** 775). Values of ultra-violet solar radiation (obtained with Miyake's ultra-violet actinometer) and of total radiation (Robitzsch's pyrheliometer) for Tokyo are graphically compared with those for the suburbs of Tokyo. Measurements were made during the winter 1950-51. It is found that city smog has a considerably stronger effect upon ultra-violet radiation than upon total radiation, especially in the morning and late afternoon. (D.S.I.R.)

243. Potential Dangers From Exposure to Diesel Locomotive Exhaust. Straub, R. L. (Industr. Med. Surg., Aug. 1955, **24,** 353-358). The potential dangers from exposure to diesel exhaust fumes are discussed from the legal angle. The more important materials in the fumes are: carbon monoxide; oxides of nitrogen, oxides of sulphur (when the fuel contains sulphur), alldehydes and similar chemicals, alergens, and carcinogens. The occurrence and effects of these materials are discussed. (D.S.I.R.).

244. Laboratory Performance of Fabric Dust and Fume Collectors. Billings, C. E., First, M. W., Dennis, R. and Silverman, L. (Washington: U.S. Atomic Energy Commission, 31 Aug. 1954, NYO-1590). Three representative commercial fabric dust

collectors have been investigated by the Harvard University Air Cleaning Laboratory to determine fundamental operating characteristics. These characteristics include resistance, collection efficiency, type of fabric, effectiveness of cleaning mechanism as related to aerosol characteristics, dust loading, and filtering velocity. Comparison of performance of these three collectors showed that the intermittently cleaned unit had high collection efficiencies with low resistance and filtering velocity, but had large variations in resistance with heavy dust loadings; the reverse jet unit had moderately high collection efficiencies, was capable of high filtering velocities, and its resistance was relatively independent of dust loading; the periodically cleaned collector had the lowest collection efficiencies and the highest operating resistances at moderate filtering velocities. (D.S.I.R.).

245. Daytime Darkness over London. N. C. Halliwell and M. J. Blackwell (Met. Mag., 1955, 84, 342-348). The authors discuss the belt of extreme darkness that crossed London shortly after midday on 16th January, 1955, causing widespread public interest and Press attention. The track of the belt is described and an attempt is made to find reasons for its formation in terms of synoptic developments preceding it and of the local distribution of smoke pollution accompanying it. During the morning of the day light winds moved smoke-polluted air from south-east London in an arc towards the north west. Trapped beneath a low level inversion the smoke moved with the surface wind field. The smoke reached the foot of the Chilterns just as a cold front was crossing them. It then returned south-eastwards, crossing London, including the western parts, and then moved on to the coast, in the Hastings area, at increasing speed. The fall in daylight illumination is illustrated by examination of the Kew daylight illumination record, which showed that the loss of light occurred within six minutes, when it became complete with almost total darkness. After a further six minutes there was a more gradual recovery to more normal conditions.

246. The Production of Blending Coke and Smokeless Fuel. G. Cellan-Jones, F.INST.F. (Coke & Gas, 1956. **18**. 52). A carbonization process, new to this country, but established in America, is described. This is known as the Coal Logs process, and will produce either a char for blending with coking coal to increase the strength of furnace coke, or a smokeless domestic fuel in the shape of cylinders of semi-carbonized material 3 in. to $3\frac{1}{2}$ in. in diameter and approximately 1 foot in length. The plant consists essentially of a lace-wire belt conveyor carrying a shallow bed of coal through a furnace, the heat being applied solely by radiation on to the top of the charge so that the belt conveyor itself is kept well below the temperatures at which it would be in danger of damage. The belt is vibrated to keep the coal in motion, thus exposing different faces of the coal particles to the source of heat and preventing the pieces of coal from sticking together. During its passage through the heated zone the coal is raised in temperature from atmospheric at the inlet end to whatever may be the final temperature desired at the outlet end.

Made in Birmingham

Transatlantic aircraft pilots had reported traces of Midlands industrial smoke 300 miles out beyond the coast of Ireland, Dr. E. T. Wilkins, of the Fuel Research Station, said in Birmingham recently. He was addressing the Midlands Joint Advisory Council for the Abatement of Smoke and Atmospheric Pollution on the development of recording of atmospheric pollution in the West Midlands.

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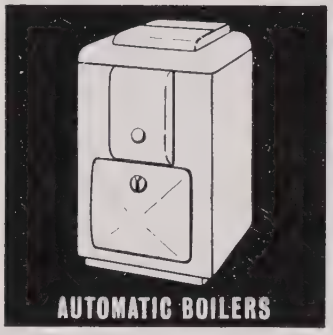
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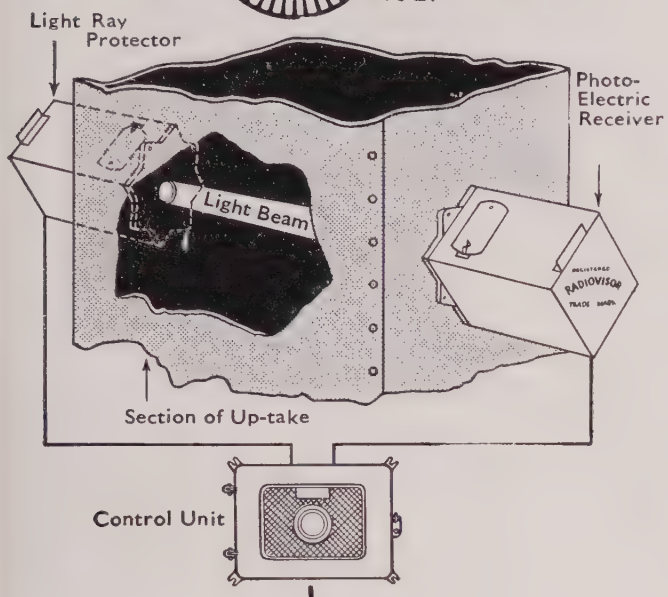
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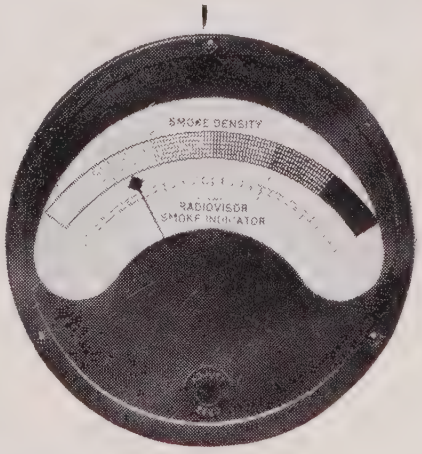
Used by Leading Industrial Companies for the past 25 years.

The Radiovisor Industrial Smoke Density Indicator is in extensive use in Power Stations and Industrial installations to give a continuous record of the smoke passing through a flue or up-take. A beam of light is projected across the flue on to a Photo-Electric Cell. The intensity of light received by the latter, and consequently the photo-electric current, is governed by the smoke density. After amplification, the photo-electric current is indicated on instruments having a Ringelmann Smoke Scale.

The Radiovisor Smoke Density Indicator operates during the whole 24 hours, indicating and recording the density of smoke emitted and showing the operator when attention is needed. In addition, an accurate record is available to the Management to prove they are not contributing to air pollution. *There is a range of standard equipment to cover all sizes and types of installations.*

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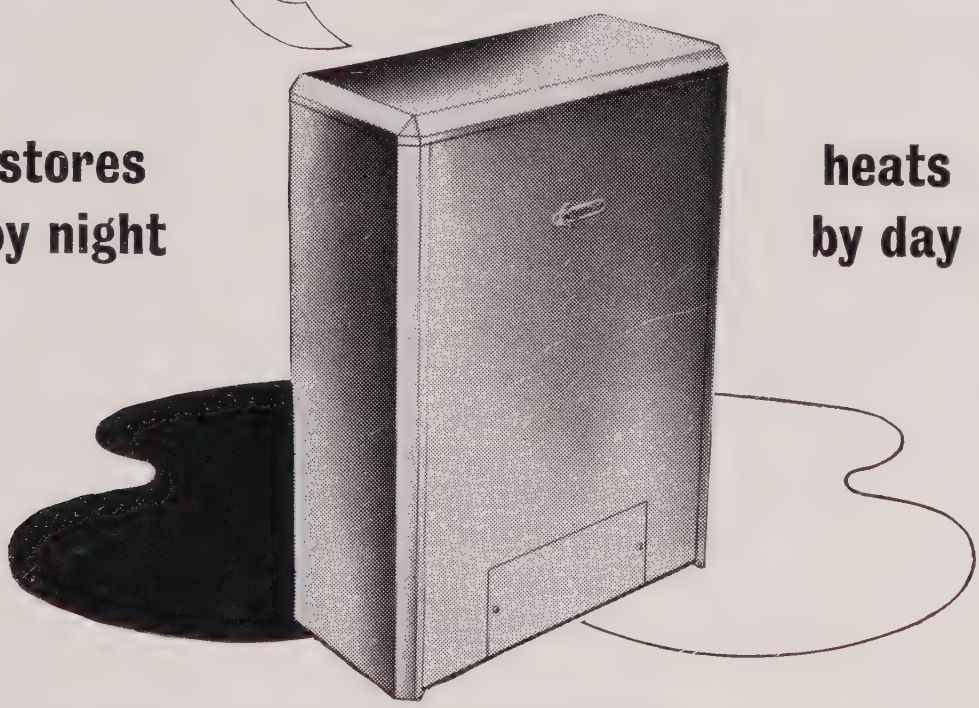
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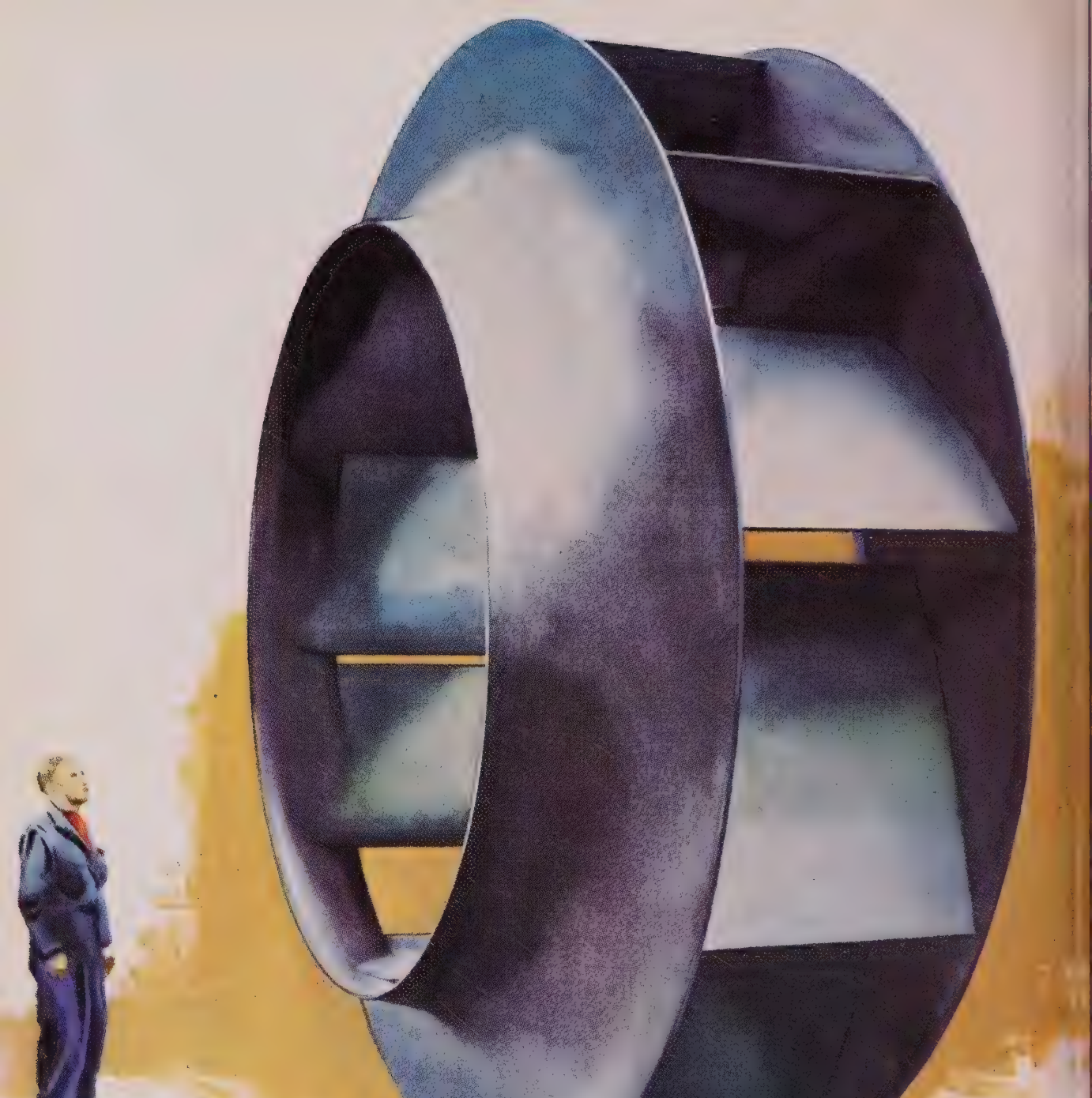
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SMOKELESS AIR

THE SMOKE ABATEMENT JOURNAL



No. 98 SUMMER 1956

ONE SHILLING

In this Issue

Synopsis of the Clean Air Bill
Environmental Causes of Lung Cancer
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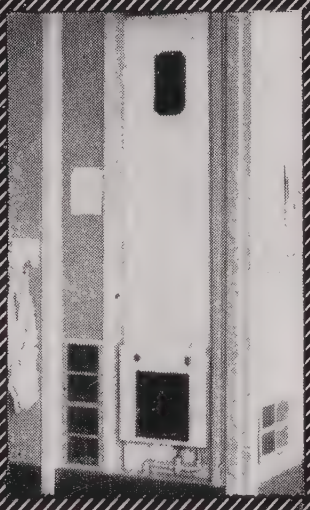
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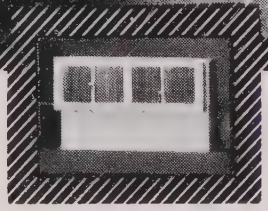
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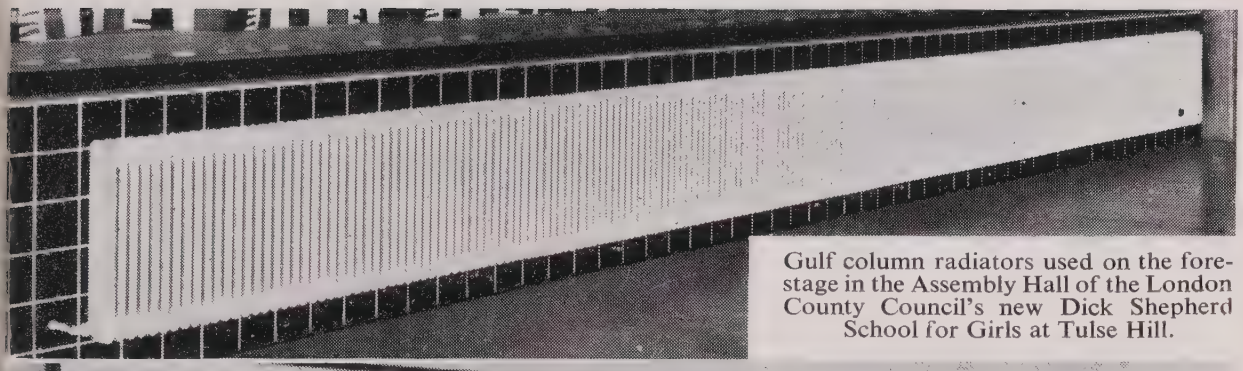
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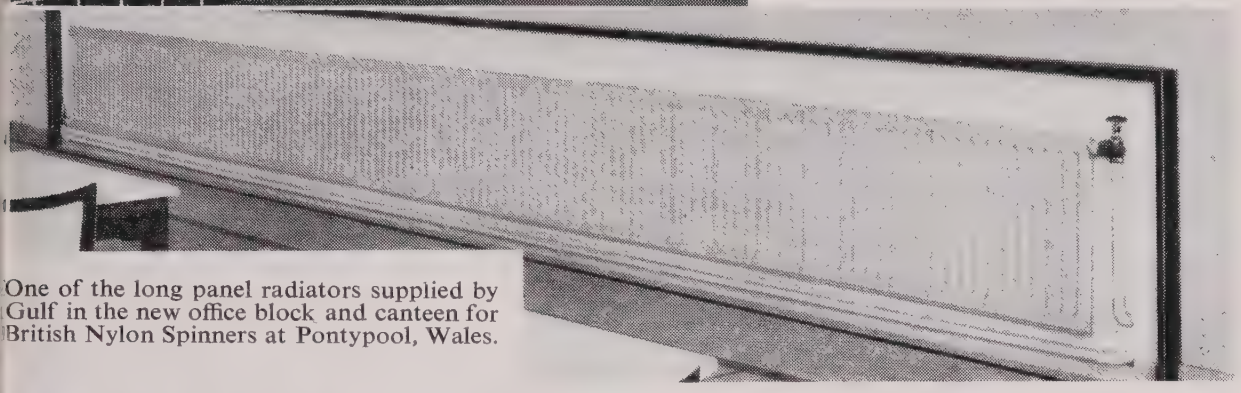
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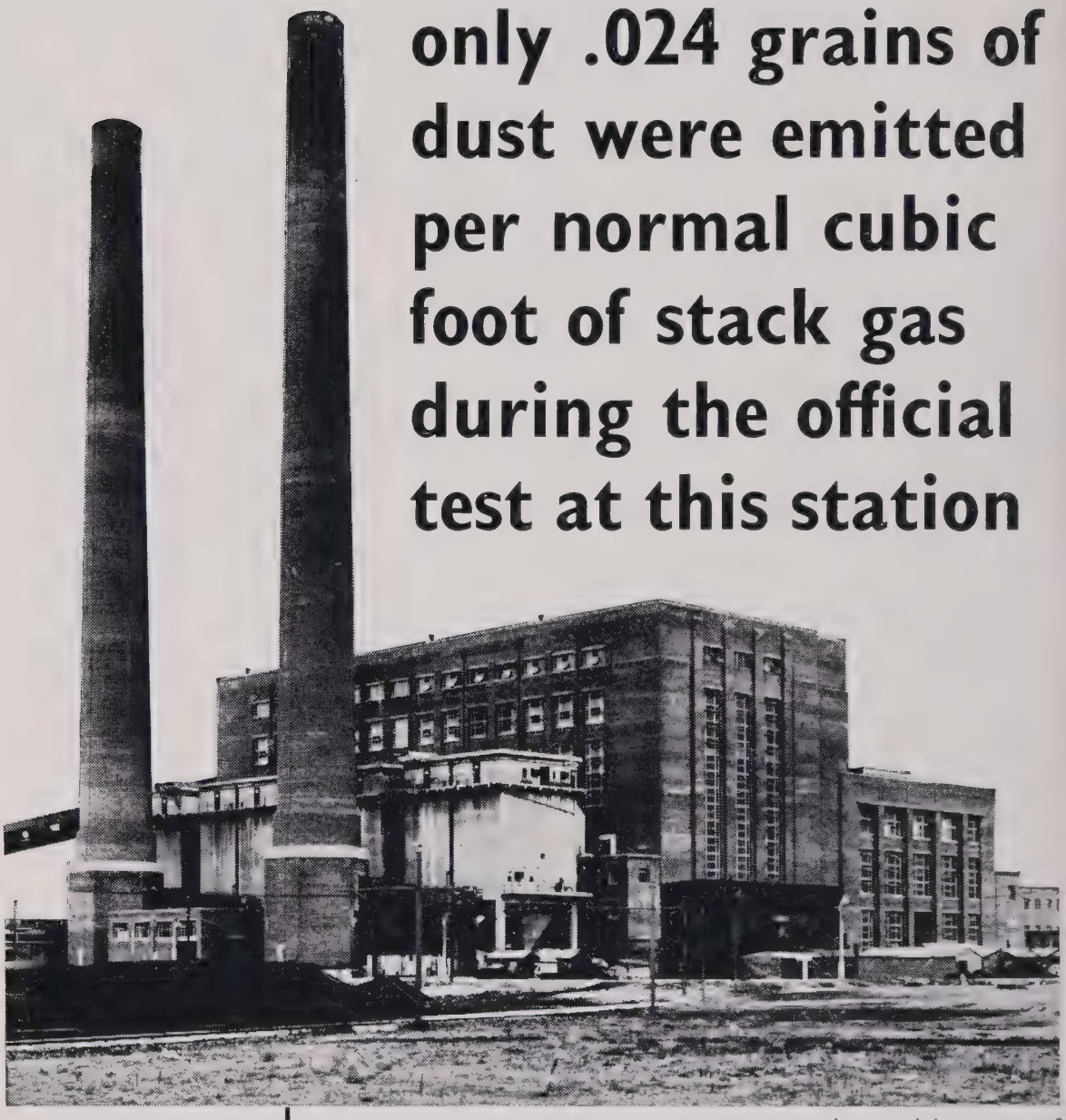
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Roosecote Power Station, showing the eight precipitator units immediately behind the stacks

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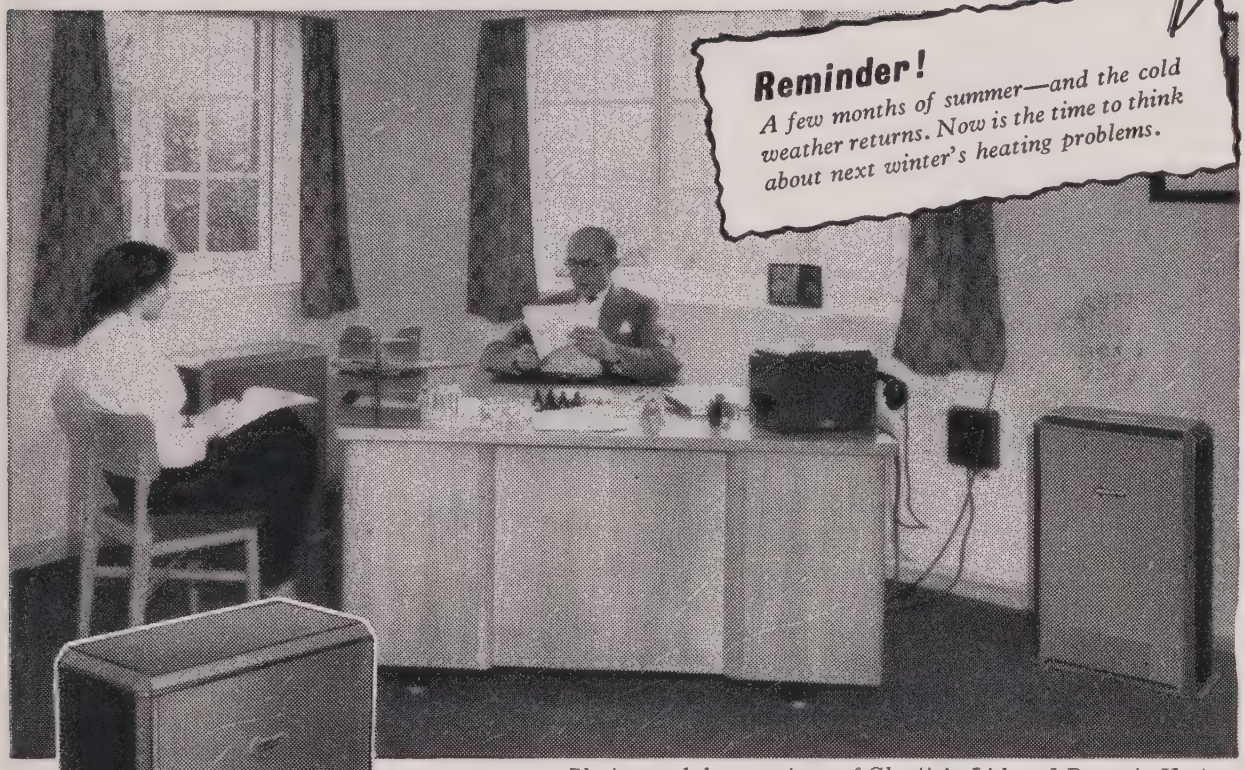
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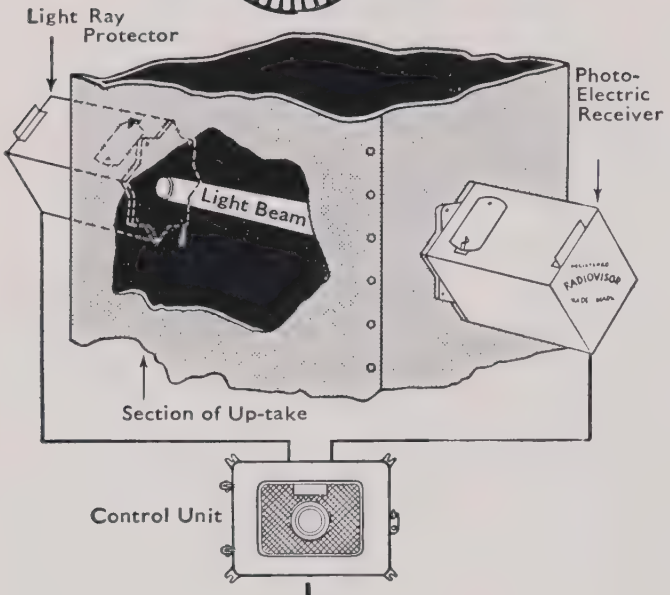
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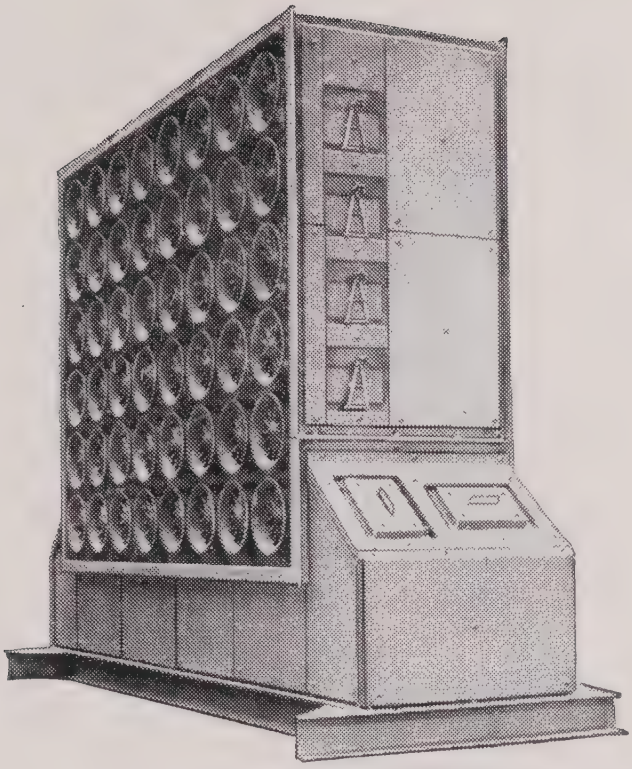
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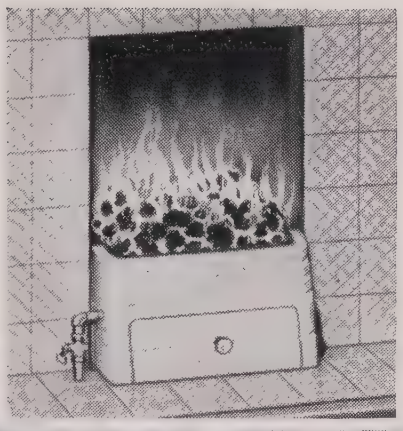
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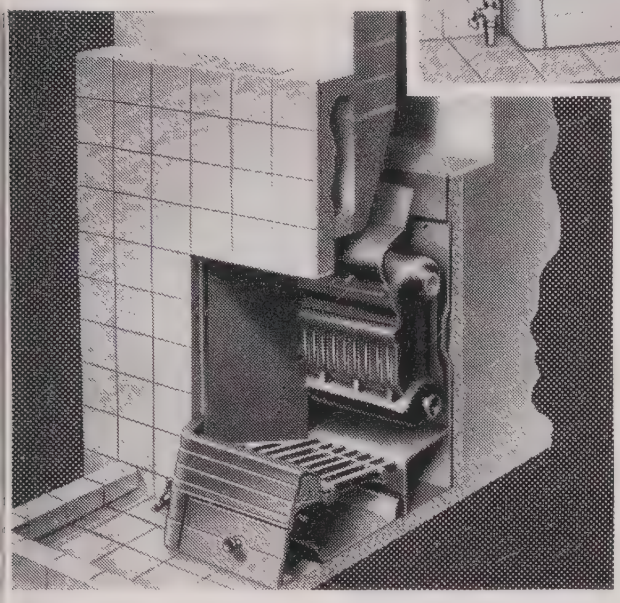
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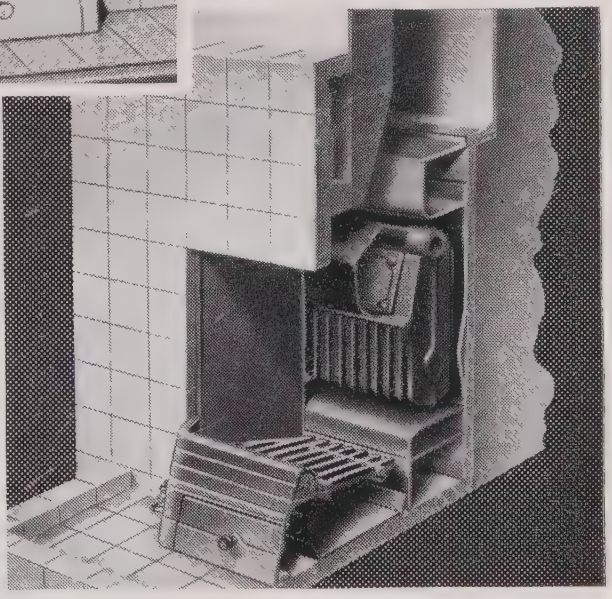
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SMOKELESS AIR

Vol XXVI. No. 98 Summer 1956

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MEMBERSHIP of the Society is invited and is open to individuals, local authorities, firms and other corporate bodies. Full details and membership application form will be sent on request.

N.S.A.S. Notices

N.S.A.S. Year Book, 1956. Contains the Society's annual report for 1955, accounts, subscription list, etc., together with an improved "General Information" section containing material of value to all who are concerned with air pollution and its prevention. Price 1s. Gratis to members and representatives.

Clean Air Act. Please note the announcement, on page 242, about a revised reprint of the descriptive synopsis of the Clean Air Bill, included in this issue, which will be published as soon as possible after the Bill has reached the Statute book.

Display Material. A new descriptive list of the Society's exhibits, posters and other display material, including new items, is now available and will be sent on request.



Ships, towers, domes, theatres and temples lie
Open unto the fields, and to the sky;
All bright and glittering in the smokeless air.

SMOKELESS AIR

Comment

The Bill Makes Progress

EDITORIALLY speaking, we are feeling peeved. It had been hoped that in this issue we would be able to report the final stages of the Clean Air Bill and the birth of the Clean Air Act, but the postponement of the Committee Stage in the House of Lords from 6th to 30th May has cut right across our printing schedule and dashed our hopes.

As most readers will be aware, the Committee Stage in the House of Commons ended shortly before Easter, and the Report and Third Reading were taken immediately Parliament reassembled after the recess. The Bill then went to the House of Lords and was given its Second Reading on 24th April. A number of further amendments were put down for consideration in Committee on 6th May, but pressure of other business—a debate on economic affairs—caused the postponement to be made.

It had been hoped, not merely to report, but to include in this issue a descriptive synopsis, section by section, of the new Act. This has in fact been done, in so far as it is possible to do so with reference only to the Bill in the form in which it left the Commons. This synopsis will be amended as required as soon as the Act itself is available, and will then be made available to readers as a separately printed booklet.

In our last issue an account was given of the amendments to the Bill that were either being suggested by, or had the active support of, the Society. It is gratifying to be able to say that a good proportion of these are now included in the Bill, and that because of them and other amendments and additions the Bill was greatly strengthened during its passage through the Commons.

Of particular importance among the changes made in the Bill are the establishment of a Clean Air Council (and one for Scotland) as statutory bodies; the obligation to notify the local authority on installing a new industrial furnace; the reduction from 10 tons to one ton of fuel per hour as the limit above which plans must be submitted and plant installed for grit arrestment; regulations to control the height of chimneys; and regulations for the installation of smoke measuring and recording instruments. It is also now provided that the Minister may by order hand over to local authority control, any premises or part of premises that are carrying out one of the processes that will be scheduled to come under the administration of the Alkali Inspectorate. Another useful change is that now, throughout the Bill, the chimney of a building is taken to include the chimney of a boiler or other plant attached to a building or fixed to or installed on any land.

The Debit Side

There are, nevertheless, a number of amendments desired by the Society or by others that the Government resolutely refused to accept. The three specific defences to dark smoke offences, including that of "unsuitable fuel," remain, and incidentally, provide defences for black smoke

which thirty years ago were regarded as unnecessary. Seven years remains the period for "temporary exemption," and there is no change in the procedure for dealing with Crown premises. So, for example, if the local hospital is turning out too much dark smoke the local inspector cannot deal with it on the spot, but his authority has to report the matter to the Minister of Health in London. There is also no provision (unless it is inserted by the Lords) for fulfilling a recommendation of the Beaver Committee that all local authorities should report annually to the Minister on their smoke prevention activities. It has been proposed that such reports should be required to be submitted to the Clean Air Council. The Council itself is not required to present any reports to Parliament: an omission that has been criticized on the grounds that it may at some future date lead to the Council becoming moribund. The Council is clearly intended to be simply a consultative committee to give advice to the Minister, and it will have no executive functions. It will not, as far as can be judged, overlap any of the purposes or activities of the National Smoke Abatement Society.

The Bill in Committee

Impressions of the thirteen sittings of the Commons committee on the Bill are mixed. There were many amendments and at times the discussion seemed over-prolonged and repetitious, but on the whole the proceedings were on a well-informed and practical level. On the Government side the burden of explaining and where necessary defending the clauses of the Bill, fell mainly on the urbane shoulders of the Minister, Mr. Duncan Sandys or, even more frequently on those of his Parliamentary Secretary, Mr. Enoch Powell. Mr. Powell had many tricky points to explain or arguments to answer, and he impressed one with his manifest understanding of every detail and the lucidity with which he made his case. He has kindly agreed to attend and speak at the Society's conference at Southport in October on the new Act—an occasion to be looked forward to.

The other Government speakers were Mr. David Renton, Parliamentary Secretary to the Minister of Fuel and Power, who dealt with matters affecting his department—such as unsuitable fuel—and Mr. Secretary Stuart, who patiently waited over many hours until it became necessary for him to speak on one of the various references to Scottish law that are dotted about the Bill to keep procedure in line with that for England and Wales.

The Conservative members of the Committee were naturally content to leave the defence of the Bill to their leaders, with of course, the exception of Mr. Gerald Nabarro, in whose name many of the amendments, including those desired by the Society, were moved. The Labour representatives on the Committee were well briefed, and ably led by Dr. Edith Summerskill and Mr. Arthur Blenkinsop, maintained a steady and sensible pressure throughout the proceedings. There was, for obvious reasons, much common ground between many of their amendments and those of Mr. Nabarro, and it is both to them and him that thanks are due for the considerable improvements that were made in the Bill. Appreciation should also be expressed to the Government for their readiness to accept so many amendments—barring, of course, those of more fundamental importance.

Perhaps one of the most significant comments made during the discussion on the Bill was Mr. Sandy's opinion that we would need another Clean Air Act in ten years' time!

Purchase Tax

It should not be forgotten that one of the recommendations of the Beaver Committee was that purchase tax should be removed from smokeless heating equipment. "We anticipate," said the Report (paragraph 72) "an increasing contribution from the continued expansion in the use of gas and

electricity, especially for cooking purposes. We consider that their use in place of house coal should be encouraged by the removal of the present purchase tax of 50 per cent. on gas and electric room and water heaters." On this important recommendation no action whatsoever has yet been taken. It is not a matter for the Clean Air Bill, but simply one for the Chancellor of the Exchequer to deal with by administrative action. There have now been two budgets since the Report was published but the tax remains.

The value of such a step would be more than the obvious help it would give to clean air policy. It is the most efficient equipment that costs the most, and it is therefore this that is hit most severely by a tax of this kind. Such a tax thus acts as an incentive to buy cheap and inefficient appliances instead of those which will help to conserve our fuel supplies. This applies to the newer and better types of convector and other gas fires rather than to electric appliances, the efficiency in use of which is virtually constant.

The failure of the Government to help to promote clean air by this simple means is a part of the general failure to encourage fuel conservation that was emphasized more than once at the recent Domestic Heating conference. In housing policy, and now in the Clean Air Bill, there is nothing to discourage the installation of the cheapest equipment that will meet with whatever minimum standards may be laid down. For the sake of a few pounds of capital cost, the householder is condemned to bear heavier running costs and the nation to waste its fuel resources just a little bit more. Over the country as a whole, and over the years, these little bits would do so much to cut down imports of fuel that even a Chancellor of the Exchequer might come to understand the importance of fuel conservation.

A Word Like Unsuitable

" Tell me," said Alice, " what is unsuitable fuel?"

" Most of it," said the Red Queen at once. " The price is particularly unsuitable. My last coal bill, for instance—".

"—That's nothing to do with it," interrupted the Red King. " Alice has been studying the Clean Air Bill, which introduces this pregnant phrase for the first time into our English—sorry, British—law. It is all quite simple. Unsuitable fuel is fuel you can't burn without making smoke."

Alice thought it over. " So if you make smoke the fuel must be unsuitable?"

" No, no. Not necessarily. You can make smoke with suitable fuel if you burn it—er—"

" Unsuitably?" prompted Alice.

" Precisely. Suitable fuel burned unsuitably makes smoke, and so does unsuitable fuel burned suitably. Only suitable fuel burned suitably doesn't make smoke."

" So that's why you are let off for making smoke if you are burning unsuitable fuel?" asked Alice.

" That's the whole point of it," said the Red King. " If you make smoke because the fuel is unsuitable it's only fair to let you off."

" So you can be fined only if you make smoke from suitable fuel?" asked Alice.

" Exactly!" said the Red King.

" So it will be safer to use unsuitable fuel?" persisted Alice.

" I suppose it will," admitted the Red King.

Alice giggled. " Perhaps everyone will start wanting unsuitable fuel, and then it will be in short supply and the poor old N.C.B. will get grumbled at for not producing enough unsuitable fuel!"

" Ridiculous," muttered the Red King and the Red Queen simultaneously, as the appalling child was seized with another odd thought.

" I suppose there will be degrees of unsuitability," she said, trying to remember something she had learned recently in school. " I mean, unsuitable, more unsuitable, most unsuitable —"

" Careful!" warned the Red Queen.

Alice was not to be deterred.

" Suppose," she continued, " suppose someone's making smoke with fuel that's only the *teeniest* bit unsuitable—would he deserve to get let off as much as if it had been the worst possible sort of fuel?"

" Border line case!" snorted the Red Queen, looking at Alice in a way that made her remark seem rather ambiguous.

" Exactly!" said Alice, seriously. " The Bill ought to have said that the fuel must be *really* unsuitable."

" That's not a legal adjective, my child," said the Red King. " The lawyer fellows wouldn't have it. You have to use a word for which there's a precedent."

" I know," said Alice, brightly, "—suitably unsuitable!"

INVESTMENT ALLOWANCES FOR FUEL SAVING PLANT

In answer to a question in the House on 16th May, the Chancellor of the Exchequer, Mr. Harold Macmillan, stated that he had it in mind that when the Finance Bill becomes law, the following fuel-saving plant should be prescribed as qualifying for investment allowance. This allowance, by promoting the modernization of fuel-burning plant generally will materially assist the clean air campaign, and in some respects is directly concerned with the prevention of smoke—as with smoke density alarms, indicators and recorders, and with smoke eliminating doors and fittings.

The provisional list, as given in *Hansard*, is as follows:

1. *Mechanical firing equipment for solid fuel*
   (*a*) Sprinkler, spreader, coking, underfeed, chain-grate, travelling grate and ram type mechanical stokers;
   (*b*) pulverized fuel burners;
   (*c*) solid fuel elevators, conveyors, bunkers and hoppers, pulverizing mills, ash skips, hoists and conveyors, installed as a necessary part of a mechanical stoker or pulverized fuel burning installation.
2. *Oil firing equipment*
   (*a*) Fully automatic, semi-automatic and hand-controlled oil burners of the following types: pressure jet; high pressure, low pressure and medium pressure air burners; steam atomizing burners; rotary cup and vapourizing burners;
   (*b*) oil storage tanks, service tanks and tank gauges, service piping, tracer lines, oil cut-off valves, oil filters and oil pumps, installed as a necessary part of an oil burning installation.
3. *Back pressure engines and turbines*
   (*a*) Engines or turbines which discharge the whole of their exhaust vapours to process steam or heating systems;
   (*b*) electrical alternators and generators, switchgear, steam driers, steam make-up valves, superheaters and de-superheaters, installed as a necessary part of a back pressure installation.
4. *Waste heat recovery equipment*
   (*a*) Flue gas feed water economizers;
   (*b*) waste heat boilers for producing steam or hot water;
   (*c*) heat exchangers and recuperators which recover heat from hot waste gases, vapours or liquids for heating other gases or liquids;
   (*d*) air pre-heaters which recover heat from hot waste gases for heating air for combustion purposes.
5. *Feedwater treatment plant*
   Feedwater treatment plant forming part of a steam boiler installation.
6. *Control equipment*
   (*a*) Devices for automatically controlling the production and distribution of heat, namely, automatic combustion regulators, automatic dampers, thermostats, pressure switches, time switches, boiler water level controls, gas pressure governors;
   (*b*) indicating and recording instruments affixed to boiler or furnace installations, namely, CO_2 indicators or recorders, draught gauges, flue gas temperature pyrometers, steam meters, boiler feed water meters, smoke density alarms, indicators and recorders;
   (*c*) devices for assisting the control of combustion in boilers and furnaces, namely, forced draught fans and induced draught fans, smoke eliminating doors and fittings of the types so far developed by the Fuel Research Station.

" By Any Other Name. . ."

In our last issue reference was made to a revision of the Society's constitution that was being examined by the Executive Council, and it was stated that one of the questions included was that of the name of the Society.

The sub-committee's draft for a new constitution has been discussed by some of the Divisional Councils and a number of further changes have been suggested. At a recent meeting of the Executive Council it was agreed that, apart from the further time needed to complete and approve the new draft, the short annual general meeting at the end of the conference might not be the most appropriate occasion for the possibly lengthy discussion that might be needed to agree upon a new constitution. It was therefore agreed that for so important a matter it would be desirable to hold a Special General Meeting later in the year, or early in 1957, for the express purpose of adopting a revised constitution and, if agreed, a new name.

A further question that has been proposed and which will call for careful consideration, is that the Society should become incorporated. If it is agreed that this should be done, then the revised constitution would become the Articles of Association and might have to be adapted for that purpose.

The Executive Council has, however, agreed that the Southport meeting should be asked to express its views on the proposed change of name, so that the revised constitution to be submitted at the later meeting can include whatever proposal about the name that appears to be favoured.

As mentioned in our last issue the suggestion is that the Society should be re-named as THE NATIONAL CLEAN AIR SOCIETY (or perhaps the National Society for Clean Air). Since then the proposal has been discussed in the Divisional Councils and by members generally, and at a guess it would seem that a fair majority are in favour. There are, however, some doubts, and perhaps it will be useful to look at the pros and cons a little more closely.

Tentative suggestions to change the Society's name have been made from time to time during the past fifteen years. Smoke abatement, it has been urged, is too weak and too restricted. The Society is, and must be, concerned with all forms of air pollution —grit, dust, fumes and gases, as well as smoke. As smoke is diminished, the first and in many respects the easiest step, the relative importance of the other forms of pollution will increase, and " smoke abatement " will become increasingly obsolescent. Already it is acquiring a touch of 19th century quaintness. The difficulty has been to find a term that is wide enough in scope, preferably positive and yet not too unwieldy. " The National Society for the Prevention of Air Pollution," for example, might do for a learned institution, but is too long and heavy for an organization like ours.

" Clean Air" had been considered— this journal began life as *Clean Air* —but the phrase was not felt to be popularly acceptable until the Beaver Committee adopted it and gave it a useful official *cachet*, enabling Mr. Nabarro to call his private Bill the Clean Air Bill, and the Government to give it the final seal of recognition in their own Bill, and in the Clean Air Council. In short whereas a few years ago Clean Air had a vagueness about it that might have meant anything, and might have suggested even more strongly than did " smoke abatement " a woolly, long-haired fraternity, today its precise and practical meaning is known everywhere and is accepted.

The only criticisms against the Society moving forward with the times are two in number. First, it is feared that there might be some confusion

with the Minister's Clean Air Council, and secondly that it would be a pity to jettison a name that has been used for so many years and has brought with it increasing success and recognition. In other words, that Smoke Abatement Society has acquired a value from its history and tradition.

Those in favour of the change think that neither of these points is valid. If a Clean Air policy is the purpose of the Clean Air Council, the Society can best indicate its support of that policy and that body by using the same terminology. It would be more confusing to continue to use a name that has a distinctly narrower meaning. Only the other day a visitor, who is concerned with the problems of grit and dust, came to the Society's offices to find out more about our objectives and work. He was under the impression that a smoke abatement society would not be interested in grit prevention, and was agreeably surprised to learn that we were, in fact if not in name, a clean air society!

There is of course something in the argument for tradition but it can be rather dangerous. It is especially dangerous when the tradition is not really old and venerable, and has not acquired the patina of history, but is simply a little old-fashioned and demodé. The Waifs and Strays Society has for obvious reasons changed its name, and is it not a fact that to many people smoke abatement belongs to the same era? It was an age when waifs and strays were an unfortunate but accepted feature of the order of things, and when smoke also was unfortunate but had to be borne. All that could be hoped for was its *abatement*.

We invite readers to let us have their views for publication in the next issue, not only on the merits of the present proposal, but possibly suggesting some still better name. And there is a further point. If the Society drops " Smoke," what of *Smokeless Air? Clean Air*, as was previously mentioned, is already in use and cannot be adopted. It may be more difficult to find an alternative more apt than that provided, with its associations, by William Wordsworth.

MRS. L. HAYHURST

The death on 12th March of Mrs. Lilian Hayhurst, M.SC., was deeply felt by her many friends in the north-west. Mrs. Hayhurst, who graduated at Manchester University in 1915, had been a member of the Smoke Abatement League (later the National Smoke Abatement Society) for many years, and Honorary Treasurer of the North West Division since 1937. For over thirty years she and her husband had lived in a " smokeless " home. Her long and devoted service to the Society was therefore backed by scientific and practical knowledge, and the enthusiasm of the born reformer.

It is pleasing to record that when the late Charles Gandy, in 1935, published his proposal for a smokeless zone in Manchester (the first in this country) Mrs. Hayhurst and her husband actually helped him in his office by outlining in red-tape on a large wall map of the city, the boundaries of the proposed zone. The area originally marked out coincided closely with that designated under the present scheme.

Those who were privileged to know Mrs. Hayhurst in her own home saw not only a most lovable human being, but a shining example of smiling fortitude in the face of long drawn out and agonizing pain. She never complained and maintained until the end a selfless interest in the work of the Society and of the city she had served so well. Her knowledge of affairs, spiced by a delightful sense of humour, made her a valuable member of the Divisional Council. She will be remembered with esteem and very sincere affection as the perfect embodiment of the " good citizen."—W.E.S.

THE ENVIRONMENTAL CAUSES OF LUNG CANCER

A U.S. Public Health Service Monograph

THE statistical connection between lung cancer and cigarette smoking has been widely publicized in this country during recent weeks, and it is not the purpose of this review to discuss either this publicity or the evidence on which it is based. It is however the duty of a journal devoted to air pollution to draw attention to the fact that other authorities attribute much greater significance to the factor of air pollution than does the current propaganda. A recent American survey of this complex problem (very briefly mentioned in our last issue) appears to have been largely ignored in this country, despite its official standing.

The survey is Public Health Monograph No. 35, entitled " A Quest into the Environmental Causes of Cancer of the Lung." It is published by the Public Health Service of the U.S. Department of Health, Education and Welfare. (U.S. Government Printing Office, Washington, D.C., price 45 cents.). The author is W. C. Hueper, M.D., who is head of the Environmental Cancer Section of the National Cancer Institute, Public Health Service, and Chairman of the Cancer Prevention Committee of the International Union Against Cancer. It is stated that in his thirty years of clinical, research and teaching experience he has become well-known both in Europe and in the United States as an authority on environmental cancer and on arteriosclerosis.

The report first discusses the general epidemiological considerations, the growth of the incidence of the disease and its wide variations in different communities. It is pointed out that the " real, definite and progressive increase " in the frequency of lung cancer started in most industrialized countries about the turn of the century, when cigarette smoking was still a habit of minor importance. The evidence that correlates lung cancer with tobacco smoking is examined and is found to have a number of discrepancies and defects. There are striking differences in the lung cancer mortality rates of different countries and different regions of the same country. The excess of mortality in urban-industrialized areas over rural areas in this country is referred to, and it has also been demonstrated for the United States in Ohio, New York and Connecticut, where analyses have been made.

Among the information that is discussed mention may be made of a recent report (Lew) which showed that the lung cancer rate was 30 to 50 per cent. higher among industrial policyholders of the Metropolitan Life Insurance Company than among males holding general policies. The holders of the latter policies are drawn mostly from middle and higher-income groups engaged in non-hazardous occupations, whereas the industrial group include a high proportion of men engaged in manufacturing, mechanical industries, mining, transportation and personal service.

" Considering the recorded strikingly irregular epidemiological behaviour of lung cancer in different countries, states, provinces, communities and population groups," says Hueper, " it is obvious that this pattern scarcely corresponds with the pattern presented by the degree and spread of the cigarette smoking habit. If the action of environmental carcinogens other than those possibly contained in cigarette smoke should mainly account for the

remarkable increase in lung cancer frequency and for the causation of a major portion of lung cancers, industrial and industry-related carcinogens would well fit this pattern since the growth of industrial establishments and the use of their products in the economic life of different countries have greatly lacked uniformity in time, type and extent."

The considerable differences in the sex distribution of lung cancers are discussed, and it is said that " considering the remarkable variations which the male-female ratio of lung cancers has shown at different times, in different localities, and in different demographic groups, it is most unlikely that such descrepancies and changes are attributable to fluctuations in the intensity of one single factor, such as cigarette smoking. Instead, they appear to be due to alterations in the type and extent of the action of a broad spectrum of environmental carcinogens affecting the members of the two sexes to different degrees."

The factors that seem to be involved are the more extensive employment of males in occupations which produce and use known or suspected carcinogens; the predominance of males in outdoor occupations, especially in urban areas, where they are exposed to carcinogenic pollutants in the general atmosphere; the greater number of males performing heavy physical labour requiring deep respiration that facilitates the penetration of air pollutants; and the fact that more males than females work through the entire span of their occupational life within the more polluted urban areas.

It is maintained that there does not exist any parallelism between the annual *per capita* consumption of tobacco in different countries and their respective pulmonary cancer death rates. " It has been calculated that the English lung cancer death rate is apparently double that of the United States, although the English smoke 30 per cent. fewer cigarettes *per capita* than Americans. This interesting and perhaps significant observation, which fails to support the validity of the cigarette theory, is disposed of by its proponents by assuming that exposure to cigarette tar is less severe for Americans who do not smoke cigarettes to the very end than for English smokers who, for economic reasons, indulge in this questionable habit."

Reference is also made to the higher incidence of the disease in New Zealand among immigrants from Great Britain compared with native-born inhabitants, despite similarity of smoking habits.

The Environmental Factors

The greater part of the monograph is concerned with a close examination of the evidence relating to occupational cancers and to the scope of general environmental hazards, the physiochemical state of atmospheric carcinogens and the topographical distribution of cancers of the respiratory tract. Specific carcinogens are considered under the following headings:

Inorganic chemicals: nickel, chromium, arsenic, iron, beryllium.

Organic chemicals: the combustion and distillation products of coal; petroleum, shale oil and natural gas.

Carbon and Silica Polymers: asbestos, isopropyl oil, mustard gas.

Radioactive chemicals.

The evidence relating to these numerous substances is presented in considerable detail which unfortunately cannot readily be summarized.

The pattern and types of respiratory cancer hazards are considered under three heads:

1. The general environmental atmospheric exposures to certain substances in the products of combustion of fuels and exhaust gases of vehicles, and a number of other specific substances that are likely to be found in the general urban environment.

2. Special and locally restricted pollutants that exist in the vicinity of certain industrial processes or other localized activities.

3. Specific occupational hazards.

The report continues: " The respiratory cancers of recognized or strongly suspected occupational origin are important, not only as industrial disease manifestations but also as prototypes of etiologically and topographically identical cancers affecting workers in other, similarly hazardous occupations as well as of those cancers involving an indefinite portion of the general population sustaining for environmental reasons contacts with the same industry-related carcinogens."

The general conclusions that may be made from the facts and observations of this comprehensive analysis may best be given by quoting directly from the author's own concluding section:

" The comprehensive panoramic view and analysis of the total epidemiological, medical, and experimental evidence available on exogenous respiratory carcinomas and carcinogens leave no doubt of the fact that not only large occupational groups but also the general population have definite and prolonged contacts with one or several of these agents.

" For most of these agents, adequate conclusive proof of their carcinogenicity is provided by epidemiological, medical and experimental data. One of the specific carcinogenic chemicals has been isolated from several agents representing variable chemical mixtures (soot, coal tar and pitch, petroleum oils, gasoline and diesel engine exhaust). Wherever a definite identification of a specific casual agent, such as isopropyl oil, asbestos, and chromates, has not yet been attained, the epidemiological evidence based on an evaluation of cancer incidence of relatively small, occupationally circumscribed total populations at risk is sufficiently reliable to prove the presence of an occupational respiratory cancer hazard causally related to a specific industrial operation. Epidemiological, medical and experimental data concerning these respiratory carcinogens attest their high carcinogenic potency under occupational conditions, particularly when acting on humans. It is therefore reasonable to assume that inhalation of the same agents, in a mitigated form as air pollutants, by the general population, is responsible for a considerable portion of the lung cancers attributable to such contacts.

" If this coherent and logical picture presented by the evidence supporting the various occupational respiratory cancers and, especially, the coal tar fume cancer of the lung, is compared with that available for the cigarette smoke lung cancer, even upon superficial examination, several additional serious defects and inconsistencies not previously pointed out become apparent."

Dr. Hueper then refers to the absence of positive statistical associations that might be expected to be present, but are absent, if the major factor were cigarette fumes: as between lung cancer and cigarette cough; cancer of the lips and oral mucosa, and cancer of the fingers even among those chronic smokers whose fingers are stained brown with tobacco tar. Further, the claimed absence of a positive association between lung cancer and the habit of inhaling cigarette smoke is also inconsistent with the rule that the incidence rate of occupational cancers increases with the intensity of exposure to a carcinogen. " The medical considerations on cigarette smoke cancer of the lung thus reveal a number of serious and fundamental defects and contradictions."

It is, perhaps, the author's final words that call for very careful and unprejudiced attention:

" . . . It is apparent that any final decision concerning the relative role of cigarette smoking in the causation of cancer of the human lung should be kept in abeyance until a great deal of additional and more valid, and especially medically conclusive, evidence becomes available. The data on hand makes it unlikely that cigarette smoking represents a major factor in the production of lung cancer and in its recent phenomenal rise in frequency. For these reasons, it would be most injudicious mainly to

Concluded, page 230



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Southport

Conference in October

The importance of the Society's 23rd Annual Conference at Southport can hardly be overestimated. It is expected that the Government's Clean Air Act will then be on the Statute Book, and in view of its paramount importance it is certain that it will give rise to a considerable amount of discussion. Indeed, as will be expected, it will be the main theme of the conference.

It will therefore be appropriate that the Parliamentary Secretary to the Minister of Housing and Local Government, Mr. J. Enoch Powell, is, as previously announced, to open the discussion on the new legislation at the first session of the conference on the morning of Wednesday, 3rd October.

Mr. Powell bore the brunt of the explanation of the Bill—and where necessary its defence—in the Committee of the House of Commons, and he had well earned the tributes he received from both his own Minister and from the Opposition. In the third reading Debate Mr. Sandys said of Mr. Powell: "I think everybody has appreciated his profound grasp not only of the Bill but, what I admire so much, his grasp of pretty well every other measure even remotely connected with the Bill. He seemed able, as I certainly could not at a moment's notice, to quote any section of any Public Health Act without the slightest hesitation. I do not know how he

does it. He seems to have a Bradshaw mind."

The conference can thus be assured that it will receive from Mr. Powell a clear, helpful and no doubt invigorating account of the Bill and what has now to be done to implement it.

The conference will not only open with a speaker of importance, but will end on a similar level, with the Des Voeux Memorial Lecture to be given by Sir Hugh Beaver.

The informal gathering held last year at the headquarters hotel was so much appreciated that there will be a similar gathering again this year at the Palace—the headquarters hotel —on Tuesday evening, 2nd October. As before, there will be no programme or speeches, but delegates will be invited to drop in to meet their friends. Refreshments will be available.

The proceedings of the conference will open on Wednesday morning, 3rd October in the Cambridge Hall, Lord Street, with a civic welcome from the Mayor, Sir Ernest Smith's retiring Presidential Address, and the address by the Parliamentary Secretary already mentioned. In the afternoon there will be a session entitled " Local Authorities and the Clean Air Act," in which Alderman G. H. Goulden of Salford, Professor Andrew B. Semple, Medical Officer of Health for Liverpool, and Mr. H. V. Cass, Chief Sanitary Inspector, Oldham, will speak.

As usual, a maximum time will be allowed for questions and discussion, since the papers will be printed and distributed in advance, and the authors will introduce them only in brief.

On Wednesday evening, a Civic Reception for delegates will be given by the Mayor of Southport.

Thursday morning will be devoted to a series of Progress Reports on some highly topical matters. Dr. P. L. Lawther will speak on " Health and Clean Air," Dr. Handley B. Howell will speak on " The effects of Fumes from Road Transport," while the " Production of Solid Smokeless Fuels " and " The Supply and Cost of Coke " will be discussed by Dr. W. Idris Jones and Mr. D. P. Welman



J. Enoch Powell

Parliamentary Secretary to the Minister of Housing and Local Government

respectively. In the afternoon "Clean Air and the Housewife " will be the topic for discussion. Mrs. M. Courtney, President of the National Federation of Townswomen's Guilds, Miss J. G. Ledeboer, a well known architect, and Miss J. M. Akester, Superintendent Health Visitor for the City of Leeds have promised to speak.

No activity has been planned for Thursday evening, as it is expected that by this time delegates will need some recreation. On Friday morning, the Des Voeux Lecture on " Clean Air: the Next Chapter " will be given by Sir Hugh Beaver, who as the Chairman of the Committee which produced the masterly Report on Atmospheric Pollution, will have much to say about the future implementation of Clean Air Policy.

The Des Voeux Lecture will be followed by the Annual General Meeting, at which the retiring President will hand over the badge of office to his successor. It is fitting that at this time a distinguished member of



Valentine, Dundee

Southport's famous Lord Street

the Society—Dr. R. Lessing—who has been associated with the Society and its parent body for over forty years, should have agreed to accept nomination as President on behalf of the Executive Council. The Conference will close as usual, about mid-day.

Environmental Causes of Lung Cancer—*concluded*

base the future preventive control of lung cancer hazards on a theory of such doubtful scientific merits and to concentrate the immediate epidemiological and experimental efforts on this apparently overpropagandized concept. The apparent wisdom of such an attitude is readily apparent from the fact that not only a great deal of the circumstantial epidemiological evidence but also practically the entire factual and conclusive evidence available on specific exogeneous causes of respiratory cancers indicates that these cancers are either of occupational origin or points to industry-related factors. Not only large occupational groups but also the members of the general population have contact with these agents in various forms and intensity."

Pittsburgh's Progress

The 1955 Report of the Bureau of Smoke Prevention, Pittsburgh, of which Mr. Sumner B. Ely is Superintendent, has been received. It is hoped to review it more fully in our next issue, and to reproduce one or two of its interesting illustrations. In the meantime we think it is significant to note a short statement about what has been felt would be a consequence of the abolition of smoke: " Now that Pittsburgh's smoke is greatly cleared, people are becoming more conscious of odours, noxious gases and fumes. The amount of work by inspectors on such complaints has greatly increased in the past year."

Smokeless Homes in Smethwick

Tenants of four-storey maisonettes to be built in West End Avenue, Smethwick, will be required to use only smokeless fuel in their open fires.

The Domestic Heating Conference

Clean Air a Main Theme

The Domestic Heating Conference of the Institute of Fuel, held in Church House, Westminster, on 1st and 2nd May, was an ambitious event, of encyclopaedic scope. No less than 45 papers were presented, or rather discussed, in the two days, marshalled into four divisions: Fuels, Heating Methods and Appliances, the Design of Dwellings and the Planning and Administration of Smoke Control Areas.

Time was insufficient for the authors even to present their papers, and each section was therefore introduced by a Rapporteur, who in each case skilfully distilled the essence from his group of papers. Each session was then open to general discussion, to which, from an audience of about 800, contributors were not lacking. Finally, on the evening of the second day, the four sections and the discussions on them were brought together by Dr. G. E. Foxwell in the role of Rapporteur of Rapporteurs. For this, and for the inspiration he clearly gave to the organizing committee, of which he was chairman, one felt he deserved a *cordon bleu*.

The papers contained a vast amount of useful information and many important suggestions and views. The volume in which they were preprinted runs to nearly a quarter of a million words, and the final volume, which will include the discussions, will be an even more formidable tome. It is as a work of reference that it will be most valuable, and as such will be of use for many years to come.

On another page we publish a complete list of the papers, with brief descriptive notes. From this it will be seen, first, how many of the papers have a direct bearing on the Clean Air policy, and secondly, how difficult it is to attempt to review them. The session on smoke control areas fittingly came last on the programme, for it was in a sense the target at which so many of the papers were aiming, and was concerned with the application of the ways and means that were the subjects of the preceding sessions, and on which the success or failure of the smoke control area policy depends.

The other sessions did, of course, deal with the whole question of domestic fuel and power usage from the points of view of fuel utilization and conservation, and the comfort and convenience (including the pocket) of the consumer. But, it all went to prove, as said Mr. David Renton, the Parliamentary Secretary to the Minister of Fuel and Power, who opened the first session, that fuel efficiency and clean air policies were Siamese twins.

There was, inevitably among so many papers, a certain amount of overlapping, but this was not considerable, and speaking generally the papers were fair and reasoned expositions of their subject matter. Much of the discussion was of value, or at least of interest, although there was a certain amount of special pleading and rather too much obvious plugging. Why do speakers not realize (and this sometimes applies to the N.S.A.S. conferences) that plugging often does more harm than good?

It was good to hear stress laid on the importance of insulation, and the castigation of the neglect of this lasting method of saving fuel that has been allowed to continue—for the sake of

saving a few pounds of capital cost—during the post-war building period.

The conference passed no resolutions, but if it had, one may hazard the thought that it would have said something like this: We have reviewed the whole field of domestic heating and cooking in the United Kingdom, and find that our standards remain deplorably low when compared with what we could achieve if we used our existing knowledge and available resources to the full. We have also considered these potentialities in great detail and given a policy that would command and co-ordinate the developments that are so urgently needed, we could at one and the same time conserve fuel, bring greater comfort, economy and convenience to every home, and ensure that the policy for clean air, through expanding smoke control areas would go forward steadily and effectively. That we are not doing all this is due to ignorance and apathy among the general public, the shortsighted economies of builders, local authorities and Government departments, and to the lack of a positive national policy for the scientific deployment of our energy resources.

THE DOMESTIC HEATING CONFERENCE

List of Papers, with notes, presented at the recent Institute of Fuel Conference

For reasons of space the 45 papers presented at the recent conference cannot be abstracted in the usual way, but for permanent reference we print the following list, with a brief note of some of the points of particular interest to readers of this journal. A volume containing both papers and discussions will be published by the Institute in due course. A general review of the conference appears on another page.

PART I. FUELS

Development of Domestic Heating in Relation to the "Egerton" Report. *Sir Alfred Egerton.* The 1945 report and its conclusions are reviewed in the light of events of the past ten years.

Sources of Domestic Heat—Present and Future. *Dr. G. E. Foxwell.* A survey from which it is concluded that the need for the future is better designs of dwellings to permit greater comfort without increased expenditure on fuel.

Smokeless Fuels Produced by the Gas Industry. *J. E. Davis.* Concludes that the complete abolition of air pollution by both smoke and sulphur can be realized to a greater extent and at a lower cost than is usually believed.

Solid Smokeless Fuel from Low Temperature Carbonization. *A Vaughan Cowell.* Describes the Coalite and Rexco processes and estimates that the additional five million tons per annum of solid smokeless fuel needed to implement the Clean Air Act could be produced by the latter process for a capital expenditure of £15 millions.

Production of Domestic Smokeless Fuels Required for the Establishment of Smoke Control Areas. *H. D. Greenwood.* Discusses the necessary wholesale re-arrangement of solid-fuel supplies and the necessary increased production.

The Use of Oven Coke for Domestic Purposes. *G. W. Lee and Dr. R. A. Mott.* Among other aspects the possibilities of expanding the production of domestic coke from coke ovens in Great Britain are indicated.

Naturally Occurring Smokeless Fuels. *E. Brooks and I. Jacob.* Deals with the location, reserves, chemical and physical characteristics, commercial classification, and present availability of these fuels.

The Production of Reactive Domestic Coke: Experiments at the Fuel Research Station. *H. Bardgett.* The principal factors which affect the

combustibility of coke are considered and their effects are noted. Results are given of experimental work on the production of reactive coke by several methods.

The Production of Free-burning Coke from Low-rank Coals in Continuous Vertical Retorts. *Dr. J. Burns and H. W. Moys.* Describes trials conducted by the North Thames Gas Board which showed that it was possible successfully to carbonize low-rank coals with a swelling index of 1-3.

Off-peak Electricity and Thermal-storage Heating. *J. W. Moule.* The paper gives details of the scope and effect of off-peak development, outlines the considerations which enter into the design of off-peak tariffs, and gives brief descriptions of the main types of thermal-storage equipment.

The Economic Aspects of Electricity for the Domestic Heating Load. *O. W. Humphreys.* Endeavours to show where electricity stands from the point of view of cost vis-a-vis alternative fuels as well as to give an indication of the absolute cost of heating electrically.

PART II. HEATING METHODS & APPLIANCES

Fuel Services in the Home. *W. F. B. Shaw.* A review is made of the principal reasons why the pattern of domestic heating in the United Kingdom has assumed its present form.

Comfort in the Home. *Dr. T. Bedford.* The warming of houses is considered on the basis of the comfort of the occupants and in relation to the recommendations made by the Egerton Committee.

The Use of the List of Recommended Domestic Solid-Fuel Appliances. *A. G. Ludgater and W. C. Moss.* A survey of the history and make-up of the List with an indication of some of its major uses. An analysis is also given of the functions and capabilities of the various modern appliances.

Domestic Heating Appliances Fired by Solid Fuel, Open Fires, Stoves and Cookers. *Dr. F. J. Eaton and S. Stephens.* Present practice in the installation of domestic solid-fuel appliances is examined, and present trends contrasted with future possibilities.

Domestic Hot-water and Central-heating Boilers Fired by Solid Fuel. *C. Fishlock and A. J. Forder.* A survey made of the available types of solid-fuel-fired boilers ranging from hand-fired units of two sq. ft. heating surface to the large automatically-controlled boiler.

Present Position and Future Development of Domestic Heating Appliances Fired by Gas. *L. W. Andrew and D. R. Wills.*

Present Position and Future Development of Domestic Heating Appliances Operated by Electricity. *E. M. Ackery.*

Oil-fired Appliances for Domestic Heating. *G. J. Gollin.* Guidance is given on selection of burners and firing systems both for new buildings and for existing premises.

Central-heating Systems. *H. H. Bruce.* Includes some consideration of small-scale " district heating " schemes.

Automatically Controlled Small-pipe Central Heating. *D. V. Brook, Dr. S. A. Burke and G. H. Bye.* The small-pipe forced-circulation system is suggested as a means of greatly reducing the wastage of heat in distribution to the various rooms in a house. Several methods of manual and automatic control are discussed.

Warm Air Systems. *Dr. W. Davidson.* The paper discusses both the completely ducted system and simpler systems which are partially or wholly conducted.

Domestic Heating in Practice—Temperatures and Seasonal Heat Requirements. *E. Danter and J. B. Dick.*

PART III. DESIGN OF DWELLINGS

Future Trends in Housing. *J. H. Forshaw.* The author offers suggestions for improvements in the design and planning of living accommodation in order to secure the maximum heat-

ing values from modern domestic installations.

Structural Insulation and Heating Systems—Values and Capital Costs. *H. F. Broughton and G. D. Nash.* Thermal insulation of houses is considered in terms of a "House U" value: methods and estimated costs of reducing this value in future houses are given.

The Relationship Between Building Design and Heating Requirements. *G. Fairweather.* This paper aims to examine the problems of the designer when considering the standards for thermal comfort required in domestic buildings.

Houses and Flats. *A. Steele.* Discusses the heating requirements of the two different types of dwelling.

Continental Practice in Heating Systems for Blocks of Flats. *R. Cadiergues.*

Architectural Problems of Heating Multi-storeyed Flats. *A. W. Cleeve Barr.* The author discusses the effect of central heating on the one hand, and of open fires or stoves on the other, on the layout of housing estates containing multi-storeyed blocks.

The Pimlico District Heating Undertaking—Costs and Financial Results. *B. Donkin, C. M. Johnston and E. Ockenden.*

A Woman's View of Domestic Heat Services. *A. D. Boyd.* Makes the point that more publicity is needed as to the sources of sound technical advice, from which the householder may benefit, and that in view of the forthcoming smoke control areas, smokeless operation may also become a factor in the choice of appliances.

Comfort, Cleanliness and Convenience. *M. R. Schofield.* This paper aims to show how a householder can enjoy a high standard of heat comfort within the framework of certain conclusions of the Ridley Committee, of which the author was a member.

Home Heating Today and Tomorrow. *The Electrical Association for Women.* This paper is based on the fact that the whole subject of home heating requires the integration of the points of view of many varying groups—engineers, health authorities, architects and town planners—with those of the housewife.

Heating the Home—A Survey of Tenants' Opinions. *M. Willis.* 600 tenants in local-authority flats in London were interviewed in order to find out their reactions to different types of heating. The results of this inquiry show the popularity of the coal fire to be declining.

Factors Affecting the Safety of Domestic Heating Installations with Regard to Fire. *N. C. Strother Smith.*

PART IV. THE PLANNING AND ADMINISTRATION OF SMOKE CONTROL AREAS

Introductory Paper on Initiation and Administration of Smoke Control Areas. *Sir H. Beaver.* The preliminary steps to be taken by a local authority in establishing a smoke control area are outlined. Reference is made to the plans that have to be worked out by the Government to ensure that the necessary supplies of smokeless fuel will be available with the coming into operation of the Clean Air Bill.

Smokeless Zones: An Introductory Survey. *A. Marsh.* This paper surveys the subject in general and includes a brief account of its history.

Smoke Control Areas and the Use of Smokeless Fuel. *Dr. J. L. Burn.* The author offers practical advice to local authorities on the establishment of smoke control areas, based on his experience in connection with the successful smokeless zones of the City of Salford.

Experience in the Development of a Smokeless Zone. *W. R. McGrath.* The author deals with the developments which led up to the smoke-abatement provisions of the City of London (Various Powers) Act, 1954, and the experience in their administration since the Act came into force in October, 1955.

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COAL-TODAY AND TOMORROW

The N.C.B.'s Report and Investment Plans

It would be easy for concern caused by the recent rises in the price of coal to mask the solid achievements of the Coal Board since its inception in 1947. They took over an industry which, owing to changes in the conditions of demand, had been shrinking for more than 25 years. The resultant fall in demand provided no incentive for increased investment during the years between the wars, and the six war years added lack of opportunity to lack of incentive. In addition to the difficulties arising from a scarcity of capital there have also been the labour troubles often associated with an extractive industry.

The success of the Coal Board in overcoming these difficulties is estimated in the *Report of the National Coal Board for* 1955, while plans for the future are clearly summarized in the interesting booklet *Investing in Coal.*

The production picture varies, as might be expected, from mine to mine. Although, compared with 1954, there has been a decline in output of 1·5 per cent., viewed over a longer period the results are not unsatisfactory. When compared with 1947, the average increase in 17 areas was 28 per cent., while the No. 6 Area of the East Midlands Division produced 75 per cent. more than in 1947. In the older coalfields in the Scottish, Durham and South-Western Division, there was an average decrease of 9 per cent. In these areas together with the North East, not only is total production low, but the number of manshifts per thousand tons tends to be high, and labour relationships tend to be poor. For instance, in the North East, there was throughout the year a consistent history of labour disputes resulting in an estimated loss of saleable tonnage of nearly 1,700,000 tons. In Durham and the South Western Divisions, the figures were 449,000 tons and 310,000 tons. In other divisions the highest losses were in the North West and West Midlands, where disputes are estimated to have lost 77,000 tons of coal.

There has been a considerable expansion of opencast mining, and according to the Report, " in many cases land is returned to agriculture in better condition than before opencast working."

The Board's Research and Development programme made some progress during the year. At the Coal Research Establishment at Stoke Orchard work is still proceeding on the production of a satisfactory low-cost smokeless fuel. At the Board's Mining Research Establishment at Isleworth research is proceeding particularly into new methods of cutting and loading the coal, and underground transport, while the new Central Engineering Establishment at Bretby in Derbyshire has already started work on the improvement of coalface machines. On the Development side, a biological method of treating the effluent from coking plants has been found satisfactory, and two full-scale plants are to be equipped with the method early in the current year. Power loading is also being extended rapidly, and it is expected that a further 200 Anderton Shearer Loaders, together with other forms of power loader will be installed during 1956. A good deal of attention has also been paid to the techniques of management, in particular to machine maintenance, method study, and standard costing. A new directive outlines the scheme of functional management.

The manpower situation is still disquieting. Total net recruitment amounted to 60,954, while total net wastage was 66,558—a loss of 5,604 workers. The North Eastern, South Western and West Midland Divisions were most severely hit because of higher wastage and lower recruitment than in 1954. A partial solution of

this difficulty may be the attempt to increase labour mobility by offering economic advancement and a house. Considerable research is taking place into the personal, social and administrative problems involved.

It is obvious that, with a declining labour force, a probably continuous rise in demand for some years, and the exhaustion of many of the older mines, the substitution of machinery for manpower wherever possible is becoming urgent. An indication of the magnitude of the problem is given by the fact that of 280 mines now producing together nearly 30 million tons of coal, none can reasonably be expected to be operating in 1970.

Investing in Coal gives a summary of the original " Plan for Coal," published in 1950, assesses the progress made under the plan, summarizes proposals for future investment, and gives estimates of production for 1960 and 1965.

The revised plan provides for an output of coal from all sources—including opencast mining—of 228 million tons in 1960 and 240 million tons in 1965. Although the output planned for 1965 is the same under the revised plan as under the original " Plan for Coal," there is a difference in source. Previously, the whole of the 240 million tons were to come from N.C.B. and licensed mines. The new plan provides for the continuance of opencast work, output from which is expected to be about 10 million tons. The Board have assumed that the use of power-loaders will continue to spread, but they have not attempted to assess the contribution which may be made by new mining methods as yet unproved. On the manpower problem, the Board assume that effective working time will remain substantially unaltered, and that they will be successful in their attempt to " get the requisite manpower in the right places." Most of the new developments will take place in the East Midlands Division, and in the older Scottish, Durham and South Western Divisions.

The proposed investment is large—£1,000 million in 10 years, but the only alternative to adequate investment is a steady decline in coal output, resulting in a chronic shortage of energy, both for industrial and domestic purposes.

DOMESTIC HEATING CONFERENCE—*concluded*

Some Observation on the Outlook for Smokeless Zones. *J. Graham.* Future prospects for the successful implementation of clean-air policy are discussed from the standpoint of the local authority.

Town Planning Aspects of Smokeless Zones. *J. S. Allen.* The author reviews town-planning legislation which has indirectly helped to mitigate the problem, by segregating noxious industries from residential areas, and examines other solutions such as smokeless zones and the careful siting of new towns.

The Housewife, Solid Fuel and the Clean Air Bill. *M. Leigh.* This paper deals with the reactions of a typical user of solid fuel to problems raised by the formation of a smokeless zone.

Winning the Public. *Dame Vera Laughton Mathews.* Methods of publicizing the Clean Air policy to housewives, both before and after the passage of the Bill, are described, together with some of the arguments likely to influence domestic consumers.

£50 for Essay on Exhaust Fumes

An award of £50 has been made by the Royal Society of Health to Mr. Douglas Lister, County Sanitary Officer, Northumberland C.C., for a prize winning essay on " The problem of engine exhaust fumes from road vehicles." This award, known as the John S. Owens Prize, is made annually by the Royal Society of Health, and attracts entrants from all parts of the United Kingdom.

THE DIVISIONS

The Annual General Meeting of the **West Midlands Division** was held in the Birmingham Council House on the 18th April, 1956. The sixty-four delegates who attended were welcomed to the City by the Lord Mayor, Alderman A. Lumis Gibson J.P., who in his address soon indicated his knowledge of smoke abatement matters from a national, as well as local point of view.

The business meeting was opened by the Honorary Secretary, Mr. G. W. Farquharson, who presented his Annual Report to the Divisional members the emphasis being placed on the need for local authorities to start planning for smoke control areas as soon as possible.

The election of officers was under discussion, but as no nominations had been received, the Chairman Councillor Eric Gibbons, and Deputy Chairman, Alderman F. W. Perry, were re-elected. The serving members of the Management Committee were also re-elected *en bloc*.

The Society's President, Sir Ernest Smith, C.B.E., then addressed the meeting. He made reference to the advent of smokeless areas in the city and the correlation between the work of the Society and the Clean Air Bill, and in the gratification that success, as regards legislation, would appear to be in sight. This splendid address was followed by one from Mr. Arnold Marsh, O.B.E., Director of the Society, who by reiterating step by step the progress during the Parliamentary Committee Stage of the Clean Air Bill, showed deep knowledge of the subject. He indicated the strength of the amendments, for and against, which had received full discussion in the Committee of the House, and gave the Divisional members a well balanced opinion of the decisions taken and of the part the Society can and could, given adequate funds, play in the future.

This address was followed by a discussion, which although somewhat brief due to a strict time-table being enforced, brought out some excellent points.

After the discussion, Mr. G. le B. Diamond, Chairman, West Midlands Gas Board, referred to the afternoon visit to the new Swan Village Gas Works. He gave statistics and financial figures relating to the production of gas and coke. Amongst other matters he said that last year the



Members of the East Midlands Division at the works of F. Perkins Ltd., Peterborough



A group at the Swan Village Gas Works. Mr. G. le B. Diamond, Chairman of the West Midlands Gas Board, is in the centre

Board had carbonized 3,400,000 tons of coal and paid £6,500,000 more for that coal than they would have had to pay before nationalization, and he showed that this was a fundamental point affecting the price of coke, the basic smokeless fuel.

The delegates were entertained at luncheon at the Queen's Hotel, and proceeded by coach, or their own vehicles to the New Swan Village Gas Works. Here the excellent arrangements by the officials of the Board, ensured the delegates being conducted around the works with excellent guides and in small groups, a most essential factor when explaining technical processes to non-technical people We saw the installation of a coal gas plant of 8·5 million cubic feet per day capacity and the new 3 million cubic feet per day water gas machine, which had been possible, within the limitations and physical restrictions of the site.

After tea, Mrs. A. L. Hayes gave a charming vote of thanks to the Board for their excellent arrangements, expressing the thoughts of the Divisional members with her special reference to Mr. J. E. Wakeford, the Birmingham and District General Manager, and to the guides and all who had contributed towards the success of the meeting. —G.W.F.

Members of the **East Midlands Division** visited the works of F. Perkins Ltd. at Peterborough on 26th April. The party was headed by Alderman S. Cooper, Lord Mayor of Leicester and Divisional Chairman.

After being welcomed at the Town Hall in the morning by the Mayor of Peterborough (Lady Benstead), the party made a tour of the Eastfield factory of F. Perkins Ltd., returning to Peterscourt for lunch.

Mr. A. Griffiths, a director and general manager of F. Perkins Ltd.,

welcomed the visitors, and said that the firm produced no smoke at all. " We heat the place with gas and oil and while it is true to say that there is no smoke without fire, I hope the converse is not true, because there is plenty of fire and zeal about this place," he continued.

Thanking Mr. Griffiths for his welcome Alderman S. Cooper said he was agreeably surprised by the kindly way in which the members had been received. After lunch a business meeting was held at the Town Hall.

The **South East Division's** activities are well maintained, and during the spring three interesting visits have been made.

On 16th March, at the invitation of the British Petroleum Co., Ltd., a party of members made a tour of the Company's Research Station at Sunbury, where they were welcomed by Mr. W. M. Tatchpole, Chief Research Chemist. The party had earlier been entertained at lunch, when Mr. P. Kent of Shell-Mex & B.P. Ltd. in the Chair made some introductory remarks as to the intended visit. The Research Station was established in 1917, and employing a staff of over 600, covers an area of 19 acres, wherein are housed seven technical sections, including various laboratories and workshops. The work being done is highly varied, and ranges from the testing of domestic oil burners to the development of refinery units by means of pilot plant tests, for which the equipment may cost many thousands of pounds. Smoke problems arising from the burning of oil products receive special attention. Research on the removal of sulphur compounds of petroleum is continuous, and possible useful applications for these compounds is being sought. The members were particularly interested in the engine research section, where tests are made on many types of motor and diesel engines. Radioactive isotopes are used to measure engine wear.

At the conclusion of the visit at the tea-table there were many questions and some discussion, particularly on the question of noxious fumes of diesel engine vehicles, and it was explained by the Company's officers how readily these emissions could be prevented and the value of careful maintenance by the owners of such vehicles was stressed.

On Friday, 20th April, some 30 members of the Division visited the Brighton Power Station at Portslade-on-Sea, where they were received by Mr. A. J. Din, the Station Superintendent, and made a detailed tour of the Station, which is in every respect modern, and is equipped with Babcock P.F. boilers and Richardson West-



Members of the South East Division at the Sunbury Research Station of the British Petroleum Co. Ltd.

garth turbo-alternators. The party was particularly interested in the electrostatic precipitators, which are designed to prevent emission of grit to the atmosphere, and were greatly impressed by the extreme cleanliness of the Station and the immediate environs. Before leaving the party was entertained to tea by the Central Electricity Authority, when Mr. Din and his colleagues answered many questions and elaborated on the details of the working at the Station.

On 18th May a limited party, restricted to the Council of the Division, spent a day at the Kent Works of the Associated Portland Cement Manufacturers Ltd. at Stone Castle, Greenhithe, Kent, through the kind invitation of Mr. I. Double, the Thames Area Manager. Much has been said and written as to atmospheric pollution set up by the process of cement manufacture and its distribution, and the members of the Council welcomed the opportunity of getting first-hand knowledge of the subject. The morning was spent touring the quarries and witnessing the excavation of the chalk and clay and the transport of these materials to the works, where the mixing and kilning takes place. The chalk was being dug by electrically driven navvies, working directly at the quarry face, and depositing the chalk into trucks for transport to the wash mills. The clay was being dug by scraper type excavators and then passed to wash mills, where it was made into slurry by the addition of water, and subsequently pumped to the main wash mills. At this point of the tour the party adjourned for lunch under the Chairmanship of Mr. Double, at the conclusion of which they viewed the coloured film entitled " A Cement Works."

Proceeding to the works the party witnessed the arrival by pipe line of the clay slurry and regulated quantities of chalk, clay and water being conveyed into great wash mills, where revolving harrows break up and mix the raw materials. The coarse slurry thus formed is treated until it is broken down and mixed to the required limits, and then pumped to large storage tanks, where it is kept agitated with compressed air and by mechanical means. The slurry is then pumped to a smaller tank, from which it is conveyed into the back end of the kiln by revolving scoops, the amount being regulated by " the burner." The rotary kiln consists of a revolving steel cylinder lined with refractory blocks. When the slurry is entering the back end of the kiln pulverized coal is being blown in at the firing end, thus drying, decarbonizing and calcining the slurry, transforming it into " clinker " at temperatures around 2,500°F. The red hot clinker then passes into kilns, from where it is transferred by conveyor to a clinker store. From there the clinker is conveyed to the mills, where it is ground to become Portland cement. As the clinker is conveyed into the mills about 5 per cent. of gypsum is added to prevent the flash setting of the cement. The finished cement is then conveyed to storage silos, from which it is loaded direct into bulk delivery vehicles, or fed to the bagging plant, which automatically fills the bags to the specified weight and seals them. A portable conveyor loads the bags on to lorries or to rail trucks, or delivers them to the quayside for loading into vessels.

The members were impressed with the very high efficiency of all the operations and the measures to prevent waste and nuisance. While there must be, by the nature of the business, a nuisance factor resulting from the processing and handling, the emission of cement dust from the very tall shafts carrying away the products of combustion is very largely prevented by electrostatic precipitation.

At the tea-table the Works Manager and his colleagues who had conducted the party answered questions as to details of the various operations. On the question of nuisance in the area it appeared that everything practicable had been done to eliminate as far as possible all cement dust reaching the atmosphere. It was understood that the bill of health of the employees at the works is of a very high order.

THE LONDON FOG OF JANUARY, 1956

Estimate of 1,000 Deaths

Dr. W. P. D. Logan, Chief Medical Statistician, General Register Office, has once more rendered a valuable service by analysing the effects of the fog in London on 3rd to 6th January, 1956. This was published in the *British Medical Journal* of 31st March, 1956. The deaths in the London Administrative County area, during the period 25th December, 1955, to 19th January, 1956, are tabulated and it is shown that the average number of deaths a day from 25th December to 3rd January was 131. If this average had been maintained during and after the fog a total of 1,441 might have been expected between 4th and 14th January, but there was in fact an abrupt rise and the deaths totalled 1,881—an excess of 440.

An alternative method of estimating the excess mortality is by comparing the numbers of deaths *registered* during the first two weeks of January with those in the last two weeks of December. This shows an excess of 454.

For Greater London (including the Administrative County) the deaths occurring each day have not been tabulated, but by making a similar estimate by comparison of deaths registered, an excess of 974 is indicated.

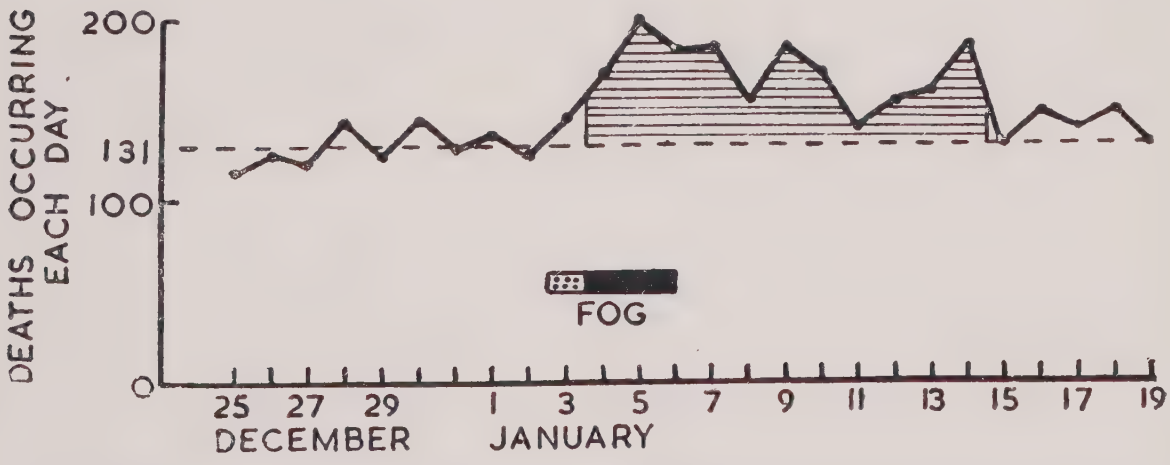
Temperature reduction during the period of the fog was not severe and by itself was probably insufficient to cause much mortality. There was no influenza epidemic in London at the time.

Dr. Logan concludes, therefore, that the additional deaths, amounting to about 1,000 in the Greater London area, were caused by the fog.

In the Administrative County area the increase in deaths were relatively greatest (67 per cent.) among newborn children, but in numbers of deaths by far the greatest number was among elderly persons—358. On the causes of death bronchitis was principally involved.

Outside Greater London, where fog was also widespread, the corresponding increase in deaths in the Great Towns was from 8,443 to 9,141—an 8 per cent. increase.

Some indication of the increased morbidity during the period is given by the increased National Insurance sickness benefits claimed in London and Middlesex, which for the first two weeks in January were 24,800 more than in the last two weeks of December, an increase of 72 per cent.



Deaths (all causes) occurring daily in London Administrative County, 25 Dec, 1955, to 19 Jan, 1956. (From Dr. Logan's B.M.J. article.)

THE CLEAN AIR BILL

A Descriptive Synopsis

This synopsis describes the Bill in the form in which it went from the House of Commons to the House of Lords, where further amendments are likely to have been made by the time of publication. These, however, are likely to be relatively few in number. It is proposed to amend the synopsis as may be necessary as soon as the Bill receives the Royal Assent and becomes an Act, and to reprint it in the form of a separate booklet. One copy of this will be supplied free of charge to any reader on request, and others will be available at sixpence each or 4s. 6d. per dozen, post free.

THE Bill deals with, in order, the control of dark smoke, smoke from furnaces, smoke control areas, and special cases of smoke emission, which include special processes to be dealt with under the Alkali Act, colliery spoilbanks, railway engines, vessels and Crown premises. It also provides for the establishment of a Clean Air Council for England and Wales and one for Scotland. In addition, there are a number of miscellaneous provisions.

This synopsis and notes are intended for general information only, and do not include many points of detail, references to other legislation and matters of administrative procedure.

Dark Smoke

Section 1 makes the emission of dark smoke from a chimney an offence. Dark smoke is elsewhere (S.32) defined as smoke that is as dark as, or darker than, shade No. 2 of the Ringelmann chart. Emissions of dark smoke within limits or classes of case to be specified by the Minister (that is, the Minister of Housing and Local Government) will be permitted. It should be noted that the emission itself is an offence, and that the question of nuisance being caused and having to be proved does not arise. Domestic premises are not excluded. It should also be noted that the section refers to the emission of dark smoke *on any day* as constituting an offence. A similar emission on another day is therefore a separate offence.

In place of the former " best practicable means " defence of earlier legislation (for smoke other than black) three specific defences are made available. It is a defence if it can be shown that the contravention was solely due to one or any combination of the following causes:

(*a*) lighting up from a cold furnace;

(*b*) Some unforeseeable and unavoidable failure of the furnace or equipment;

(*c*) the use of unsuitable fuel, suitable fuel being unobtainable and the fuel that was used being the least unsuitable that was obtainable.

In each of these cases the defence has to be proved, and it is also necessary for the defendant to show in (*a*) and (*c*) that " all practicable steps had been taken to prevent or minimize the emission of dark smoke."

Although the section refers to dark smoke emitted from the chimney of a building, a further subsection provides that this shall include a chimney serving a furnace or other plant that is " attached to a building " or " installed on any land."

Section 2 relates to temporary exemptions from the preceding section. For a period of not more than seven years from the passing of the Act it will be a defence in any proceedings to prove (*a*) that the contravention was due to the nature of the building and equipment and not to failure in use or maintenance, *and* (*b*) that it had not been practicable to make the alterations necessary to prevent the emission of dark smoke. On application, the local authority *may* at any time during the seven years, issue a certificate (for one year, but renewable) stating that they are satisfied that it had not been practicable to make the required alterations. If they do this, the certificate would be conclusive evidence under defence (*b*). Such a certificate may be limited to particular chimneys of a building.

Smoke from Furnaces

Section 3 requires all new furnaces (except domestic) to be capable of being operated continuously without emitting smoke when burning fuel of a type for which they were designed. If the plans and specifications for a new furnace are submitted to and approved by a local authority the installation will be deemed to comply with the provisions of this section, so that it will not be an offence *under this section* if the furnace at any time should emit smoke. There is, however, nothing to preclude action for offences under other sections of the Bill.

It will be an offence to install a new furnace without previously notifying the local authority. It should be noted that notification is obligatory, but that the submission of plans for approval is optional.

Section 4 provides for regulations to be made by the Minister requiring the installation of apparatus to indicate and/or record smoke density, or to facilitate the observation of smoke. The regulations may impose requirements about the adaptation of chimneys, the use and maintenance of the apparatus, and making records available to the local authority.

Grit and Dust from Furnaces

Section 5 requires the use of any practicable means there may be for minimizing the emission of grit and dust in any furnace used to burn solid fuel or solid waste. It includes ovens used to subject solid fuel to any heating process, but excludes domestic furnaces.

Section 6 relates to all furnaces burning pulverized fuel and to furnaces burning one ton an hour or more of solid fuel in any other form. In such cases the grit arresting plant has to be installed in accordance with plans and specifications submitted to and approved by the local authority, and it must be properly maintained and used.

The Minister may give directions to local authorities that applications for approval of grit arresting plant shall be referred to and dealt with by him. Such directions may be made to any local authority or to local authorities generally, and may relate to all or only to specified classes of applications. If an application is made to a local authority and its decision is not satisfactory to the applicant an appeal may be made to the Minister.

Section 7 empowers the Minister to make regulations covering the making and recording of measurements of grit and dust emission, including the adaptation of the chimney, providing and maintaining the necessary apparatus, and informing the local authority of the results. Different regulations may be made for different types of furnaces. These regulations will apply to furnaces burning pulverized fuel and those burning more than one ton of fuel an hour, provided that the local authority serves notice in writing to that effect.

Section 8 states that to enable the local authority to perform its functions under the two preceding sections it may demand from an occupier such information as it may reasonably require for that purpose.

Section 9 controls the heights of chimneys, other than those of residences, shops and offices. If the plans for a new building, submitted in accordance with building byelaws, show that it is proposed to construct a chimney, they shall be rejected unless the local authority is satisfied that the chimney will be of a height " sufficient to prevent so far as practicable the smoke grit dust and gases from becoming prejudicial to health or a nuisance." Regard must be given to the purpose of the chimney, the neighbouring buildings, the levels of the neighbouring ground, and any other relevant matters. If plans are rejected an appeal may be made to the Minister. The section does not apply to electricity generating stations, other than private ones.

Smoke Control Areas

Section 10 provides that any local authority may make an order, which must be confirmed by the Minister, declaring the whole or any part of its district as a smoke control area. Subject to any stated exceptions and limitations, the emission of smoke in such an area, on any day, is an offence. It is a defence if the emission was caused only by the burning of an authorized fuel.

Considerable variations in the terms and conditions of the order are possible. The provisions may be different for different parts of the area, and the order may be limited to specified classes of buildings, or may exempt specified buildings or classes of buildings. Specified fireplaces and classes of fireplaces may also be exempted. A smoke control area may therefore be a smokeless zone in the original sense of that term, or may be an area in which defined emissions of smoke are permitted.

The Minister may make orders exempting any class of fireplace if he is satisfied that such fireplaces can be used for burning fuel other than authorized fuel " without producing smoke or any substantial quantity of smoke."

The Minister may also suspend or relax the operation of a smoke control area order, although he must (except in cases of emergency) first consult with the local authority.

Adaptation of Fireplaces

Section 11—If the owner or occupier of a private dwelling which is in, or will be in, a smoke control area has to incur expenditure in adapting his heating arrangements, the local authority shall repay to him at least seven-tenths of the sum. If it thinks fit it may in any case pay the whole or any further part of the remainder. This repayment is contingent on the work being done to the satisfaction of the authority, and that it is done either before the order comes into operation or done afterwards as a result of an order made by the local authority requiring it to be done.

A further requirement concerns adaptations made by an occupier who is not the owner of a house, and who installs equipment that can readily be removed. In such cases not more than half the amount due (*i.e.*, seven-twentieths of the cost) shall be repaid until after two years from an order coming into operation. The remainder shall then be paid only if the equipment has not been removed, and it is paid to the person then occupying the dwelling.

If adaptations are not made as required in a smoke control area, a local authority may serve a notice calling for the work to be done, or may execute it themselves under the provisions of Part XII of the Public Health Act, 1936, and may demand a payment of three-tenths (or less) of the expenses incurred.

Section 12 relates to Exchequer contributions which may be made to local authorities in respect of expenses incurred in making adaptations. In the case

of payments made for houses owned or controlled by the local authority this will be two-fifths of the total; in the case of privately owned houses the amount will be four-sevenths of the contribution made by the local authority. The effect of the division of payments laid down in this and the preceding section is that the owner or occupier of a house will pay three-tenths, the local authority three-tenths, and the central Government the remaining four-tenths. If the local authority is the owner it will pay six-tenths to the Government's four. In any case where the local authority pays more than the seven-tenths of the cost borne by a private owner or occupier, the Government contribution will be proportionately larger.

Section 13 gives an interpretation of the two preceding sections. This states that the work done, whether inside or outside the dwelling, may include adapting or converting a fireplace, replacing it by other means of heating or cooking, altering the flues, and carrying out any consequential operations. The work must include only what is reasonably necessary to avoid contravention of a smoke control area order, and any expense beyond this must be left out of account.

The references to expenses include the cost of fixing appliances even though they can be easily removed without damage to the fabric of the building. If payment is made to a person in respect of an appliance which he is buying under a hire-purchase agreement, it will be treated as if the cash price of the appliance had been paid on the date of the agreement.

Section 14 gives local authorities power, under section 10 of the Act, to make grants towards the cost of adaptations, as in the case of dwellings, to owners or occupiers of churches, chapels, other places of worship, and premises used by non-profit making organizations whose main objects are charitable or concerned with the advancement of religion, education or social welfare.

Smoke Nuisances

Section 15 is concerned with smoke other than that from the chimney of a private dwelling, and other than dark smoke emitted from a chimney. That is, it is concerned with non-domestic smoke of any shade that is not emitted from a chimney, and any smoke lighter than Ringelmann No. 2 that is emitted from a chimney. This section and Section 1 cover between them all smoke other than light smoke from a dwelling, which is actionable only when it is in a smoke control area.

The procedure under this section is however different from that under section 1. If smoke with which the section is concerned is a nuisance to the inhabitants of the neighbourhood it is deemed to be a statutory nuisance under Part III of the Public Health Act, 1936. Under this, if the local authority are satisfied that a statutory nuisance exists an " abatement notice " may be served. If this notice is disregarded or if the nuisance is abated but is likely (in the opinion of the local authority) to recur, the authority may make a complaint to a justice of the peace and a summons is then issued for the person concerned to appear before a magistrates' court. If it is there proved that a nuisance does exist or may recur, a " nuisance order " may be made requiring the defendant to comply with all or any of the orders of the abatement notice, or to take steps, including executing necessary works, to abate the nuisance. The order may also prohibit the recurrence of the nuisance.

The section amends in some important respects the terms and procedure laid down in the Public Health Act, as follows:

1. Section 109 of the Public Health Act no longer applies to smoke nuisance. This is the saving from the operation of Part III of that Act of mines and certain industrial processes. (The so-called " Sheffield Clause ").

That is, section 109 remains in force in respect of other statutory nuisances (*e.g.* dust) but not in respect of smoke.

2. The maximum fines for contravening or failing to comply with a smoke nuisance order is £10, and a further £5 for each day that the offence continues.

3. In the case of smoke emitted *from a chimney* it will be a defence to prove that the best practicable means had been used to prevent it.

4. Power is given to a local authority (15 (2)), if they are satisfied that a nuisance has occurred and is likely to recur, to dispense with the serving of an abatement notice, and at once cause a complaint to be made to a justice of the peace, following which the procedure is as summarized above.

Special Cases

Scheduled Processes

Section 16 states (in subsection 1) that (with the exception noted below) the preceding provisions of the Bill shall not apply to premises controlled under the Alkali, etc., Works Act. Under that Act certain chemical processes are scheduled and noxious or offensive gases are listed. These scheduled processes must be registered annually and the best practicable means used for preventing the escape of noxious or offensive gases or limiting the effluents discharged. The Act is administered by an Alkali Inspectorate. The Clean Air Bill now provides that the Alkali Act shall have effect in relation to smoke, grit and dust from scheduled processes as it has in relation to noxious or offensive gases, and that references in the Alkali Act to such gases shall be construed as including smoke.

Under Section 27 of the Bill it is laid down that it shall be the duty of the local authority to enforce the Clean Air Act, but that this duty does not extend to enforcing any of the provisions of the Alkali Act. Nevertheless the second part of section 16(1) provides that action may be taken by a local authority in respect of sections 1, 5 and 15 (dark smoke, grit, and smoke nuisance) in relation to premises controlled under the Alkali Act, provided that (in England and Wales) the consent of the Minister is obtained.

Thus if a scheduled process is emitting dark smoke or grit, or causing a nuisance, it could be dealt with under the Alkali Act as if it were a case of the emission of noxious or offensive gases. If, for any reason, the Alkali Inspector failed to exercise his powers, the local authority could seek the consent of the Minister for them to take action under the appropriate section of the Clean Air Act.

Subsection 2 of this section gives power to the Minister to make orders transferring from control under the Alkali Act, to a local authority, the whole or a specified part of any *premises*. It will be noted that the reference is to premises and not to processes or areas.

In any such action taken against such premises in respect of dark smoke under section 1, the additional defence is made available that the best practicable means had been used to prevent or minimize the emission. In any action under section 15 (smoke nuisances) the best practicable means defence is available whether the smoke was emitted from a chimney or not. Orders made under this subsection may be revoked or varied by the Minister by a subsequent order.

Subsection 3 extends the power of the Minister to make orders adding to, varying or revoking the list of works controlled under the Alkali Act, while subsection 4 refers to the second schedule of the Bill, which amends the Alkali Act so that penalties for certain offences are brought into line with comparable offences under the new Bill.

Subsection 5 is important and should not be overlooked. References to premises controlled under the Alkali Act are references only to that part of the registered works that is directly concerned with the processes that have necessitated the registration. The Minister may from time to time determine how much of any such works is directly concerned with these processes.

Colliery Spoilbanks

Section 17 requires the owner of a coal or shale mine or quarry to employ all practicable means for preventing the combustion of deposited refuse. He must also prevent or minimize the emission of smoke or fumes if they occur. If he fails to do so he is guilty of an offence.

The Public Health (Coal Mines Refuse) Acts of 1939 (one of which relates to Scotland) are repealed, and (with the exception noted below) neither section 92 of the Public Health Act, 1936 (Statutory Nuisances) nor section 16 of the Public Health (Scotland) Act, 1897, nor any other provision of the present Act are to relate to colliery spoilbanks.

The section is not, however, to be applied to deposits which at the time of the passing of the Act are no longer in use as such and are not under the control of the owner of the mine or quarry. In such cases it would be possible to use the statutory nuisance procedure of the Public Health Acts or the smoke nuisance procedure of the present Act.

Railway Engines

Section 18 relates to railway locomotive engines, and provisions in earlier Acts for the abatement of smoke from railway engines are repealed by the present Bill.

Section 1 of the Bill (dark smoke) is to apply to railway locomotives as it applies to buildings, and for references to the occupier of the building are to be substituted references to the *owner* of the engine.

In addition, the owner of any railway engine must use any practicable means there may be to minimize the emission of smoke, and is guilty of an offence if he fails to do so and smoke is emitted. Nothing else in the Act applies to smoke, grit or dust from a railway engine.

Vessels

Section 19. Sections 1 and 2 of the Bill may be applied to vessels in specified waters as they are applied to buildings. For references to the occupier of a building there are to be substituted references to the owner of the vessel, or to the master or other person in charge of it. Reference to a furnace is to include reference to the engine of a vessel.

The section can be applied to vessels which are in any water that is not navigable to a sea-going ship. It can also be applied to a ship in any water that is navigable to a sea-going ship, provided that it is " contained " within a port, harbour, river, estuary, haven, dock, canal or other place *where charges for use of facilities may be made.* " Charges " refers to charges which some person or body is authorized to make under any Act, and does not include light dues, pilotage, etc.

If a ship is in any water to which the section applies but this is not within the district of any local authority, then it is deemed to be within the district of the authority that contains the point of land nearest to the ship.

Crown Premises, etc.

Section 20 is concerned with the control of smoke, grit or dust from Crown premises—that is, premises under the control of any Government department and occupied for the public service of the Crown, or for the purposes of a Government department.

It is part of the function of a local authority to report smoke emissions to the Minister responsible for the premises concerned, whether the smoke is dark smoke, smoke within a smoke control area, or smoke which appears to be a nuisance to the inhabitants of the neighbourhood.

The Minister concerned shall then make an inquiry into the circumstances, and if it is found that there is cause for complaint he must employ all practicable means to prevent or minimize the emission, or to abate the nuisance and prevent its recurrence.

The premises covered include H.M. Navy vessels, Government ships in the service of the Admiralty, premises occupied for the purpose of the Duchies of Lancaster and Cornwall, and premises occupied by a visiting force (as defined in the Visiting Forces Act, 1952). In the last case the responsible Minister is the one whose department made the arrangement with the visiting force for the occupation of the premises.

Section 19 of the Act (Vessels) does however apply to vessels owned by the Crown, other than those of the Navy or in the service of the Admiralty, with the omission of the reference to the " owner."

Clean Air Council

Section 21 provides for the appointment, by the Minister of Housing and Local Government, of a Clean Air Council, of which he shall be the Chairman. A similar Clean Air Council for Scotland shall be appointed by the Secretary of State for Scotland, who will be Chairman.

Both Councils are defined as consultative councils and their purposes are laid down as:

(*a*) keeping under review the progress made (whether under this Act or otherwise) in abating the pollution of the air in England and Wales, and in Scotland; and

(*b*) obtaining the advice of persons having special knowledge, experience or responsibility in regard to prevention of pollution of the air.

Miscellaneous Provisions

Building Byelaws

Section 22 states that " building byelaws may require the provision in new buildings of such arrangements for heating or cooking as are calculated to prevent so far as practicable the emission of smoke."

This is similar to section 104(2) of the Public Health Act, 1936, which, however, referred to new buildings other than private houses, and required arrangements " calculated to prevent or reduce the emission of smoke ". (It may be noted that no such byelaws have been made, or any model proposed or approved by the responsible Minister).

Research and Publicity

Section 23 gives local authorities power to undertake or contribute towards the cost of relevant investigations and research. It further empowers them to conduct publicity and educational work by lectures, exhibitions, films, displays and the like, and to prepare or contribute towards the cost of preparation of the material required for this work.

Disclosure of Information

Section 24 makes it an offence for any person to disclose information about a manufacturing process or trade secret that he has obtained as a result of administering the Act. Disclosure is, however, allowed with the consent of the person carrying on the undertaking, if it is necessary in connection with the execution of the Act, or for the purpose of, or reporting, any legal proceedings.

Penalties

Section 25 sets out the liability of any person found guilty under any offence under the Bill and may be summarized as follows:

Dark Smoke (S.1): For private dwellings, a fine of £10 maximum; all other cases, £100 maximum, for each offence.

New Furnaces not Smokeless (S.3): A fine of £10 maximum.
Smoke Emission in Smoke Control Areas (S.10): A fine of £10 maximum, for each offence.
Disclosure of Information (S.24): A fine of £100 maximum, or imprisonment up to three months, or both.
All other offences: A fine of £100 maximum.

When the court is satisfied that an offence is substantially a continuation or repetition of an earlier offence for which a conviction has been made, the defendant may be fined up to £100, or £20 for each day on which the earlier offence has been repeated, whichever is the greater. The two offences must be within three months of each other.

A subsection relating to Scotland is to the effect that any offence for which the maximum penalty is not more than £10, may in Scotland be prosecuted in any court of summary jurisdiction that has jurisdiction in the place where the offence was committed.

Authorization of Works

Section 26 provides for the case of the occupier of a building who is obliged to carry out works to enable him to comply with the provisions of the Act, but who needs and cannot obtain the necessary consent of the owner. The section allows him to apply to a county court (in Scotland to the sheriff) for an order to enable him to carry out the work. He may also ask for an order directing the owner or other person to indemnify him in respect of the whole or part of the cost. The court is required to make such orders as they think just.

Enforcement

Section 27 states that it shall be the duty of the local authority to enforce the provisions of the Act, but that this is not to be construed as extending the enforcement of any of the provisions of the Alkali Act or any building byelaws.

A local authority in England and Wales may institute proceedings for an offence under section 1, in the case of smoke that affects any part of their district, even though the smoke is emitted from a chimney outside the district. This authorization does not extend to Scotland.

Notification of Offences

Section 28. If an authorized officer of a local authority considers that an offence is being or has been committed with respect to dark smoke (S.1), smoke in a smoke control area (S.10) or smoke which is a nuisance (S.15) he must, " as soon as may be " notify the occupier of the premises (including the owner of a railway locomotive or person in charge of a vessel). If this notification is not in writing he shall confirm it in writing within 48 hours.

In any proceedings under sections 1 or 10 it is a defence to prove that the foregoing requirements have not been complied with. If notification has not been given within the two days following the day of the offence the requirements are deemed not to have been complied with (unless the contrary is proved).

Section 29 relates the Bill to the provisions in the Public Health Act, 1936 and to other legislation, including Scottish, that concern local administration, etc. This is subject to modifications and supplementary provisions contained in the Third Schedule to the present Bill.

Among other matters it provides for the declaration of a smoke control area that includes part or the whole of the districts of two or more local authorities, and for its joint administration. References in the Bill to a local authority in relation to a building, dwelling, boiler or industrial plant in a smoke control area shall however be the concern of the local authority in whose district it is situated.

References in the Bill to local authorities and their districts are to include references to port health authorities and joint boards that have functions under the Bill. No part of the district of any such authority or board may be treated

as forming part of the district of any other authority.

The power of a local authority to join with others in establishing a joint committee (under S.91 of the Local Government Act, 1933), is confirmed, but a joint committee which includes persons who are not members of the appointing authorities shall be advisory only, and no functions may be attached to it.

Section 30 relates to the application of the Act to London and the port health district of the Port of London, and **Section 31** relates to regulations, orders and administrative expenses.

Interpretation

Section 32 interprets various words and phrases as they are used in the Act. The majority of these follow the usual lines and need not be repeated. The following points may however be noted.

" Appointed day " means a day appointed by order of the Minister, and different days may be appointed for different purposes, different areas and different provisions of the Act.

" Chimney " includes structures and openings of any kind through which smoke may be emitted (or when the reference is to an oven, through which dust and grit may be emitted).

" Industrial plant " includes stills, melting pots and other plant, together with incinerators, used for or in connection with any industrial or trade purposes.

" Local authority " as respects Scotland, means a county or town council.

" Oven " includes any form of retort or container used to subject solid fuel to a process involving the application of heat.

" Practicable " means " reasonably practicable having regard, amongst other things, to local conditions and circumstances, to the financial implications and to the current state of technical knowledge."

" Practicable means " includes " the provision and maintenance of plant and the proper use thereof."

" Smoke " is now interpreted as including " soot, ash, grit and gritty particles emitted in smoke." (The final words " emitted in smoke " were not in the Public Health Act, 1936, interpretation of the word).

Subsection 2 interprets " dark smoke " as smoke which if compared in the appropriate manner " with a chart of the type known at the date of the passing of this Act as the Ringelmann chart " appears to be as dark as, or darker than, shade number 2 of the chart.

If, however, a court is satisfied that the smoke is or is not dark smoke as so defined it is not necessary that there should have been a comparison with a Ringelmann chart. Further, the Minister may make regulations prescribing other methods of ascertaining whether smoke is dark, and provided that such a method is properly used, the evidence obtained by its use will be accepted as sufficient.

Among the other subsections is one which states that in considering what works are necessary to enable a dwelling or other building to comply with the Bill, regard shall be had to any difficulty in obtaining (or obtaining only at a high price) " any fuels which would have to be used but for the execution of the works."

Any furnaces being used by the same person which are served by the same chimney, are to be regarded as one furnace.

Section 33 gives details of repeals and transitional provisions. Among these is the power of the Minister to repeal—after consultation with the local authority or county council concerned—any provision of any local Act which the new Act appears to make unnecessary. With respect to smoke control areas the repeal (which would concern Smokeless Zones) cannot be made without the *consent* of the local authority.

Section 34 excludes Northern Ireland from the provisions of the Act, but gives power to the Parliament of Northern Ireland to make any similar law.

Section 35, the final section, says that the Act may be cited as the Clean Air Act, 1956, and that it shall come into operation on the appointed day.

There are four schedules appended to the Act, as follows:

Schedule 1—Relates to the confirmation and coming into operation of orders of local authorities under section 10 (smoke control areas). It is concerned with the procedure for the publication of a proposed order and its advertisement, the holding of an inquiry by the Minister if any objections are made and not withdrawn, its confirmation or otherwise by the Minister, and the date on which it can come into operation.

Schedule 2—Relates to amendments of the Alkali &c., Works Regulation Act, 1906.

Schedule 3—Relates to the modification of the Public Health Acts, etc., and to supplementary provisions. The Acts concerned are the Public Health Act, 1936, the Public Health (London) Act, 1936, the Public Health (Scotland) Act, 1897 and the Housing (Scotland) Act, 1950.

Schedule 4—Tabulates the enactments repealed, either wholly or in part, by the new Act.



From our Photo-Library, No. 25 *Iris Hardwicke*

GOING, BUT NOT GONE!

Third Reading

The Commons Sums up on the Clean Air Bill

THE Report and Third Reading of the Clean Air Bill were taken in the House of Commons on 10th April. We record some of the points from speeches that seem to epitomize the general attitude of the Government, and of the House as a whole, on the Bill.

Mr. Powell: I beg to move, That the Bill be now read the Third time.

At this late stage in proceedings on the Bill, there is no need for me to recapitulate those events, which are fresh in the memory of most of us, which in the last two or three years have intensified public interest in the purity of the air. Changes of many kinds in the techniques of using fuel and generating power have made it possible to impose much higher standards and much stricter requirements than would have been practicable as little as a decade or two ago. The Bill represents an attempt to capitalize our gains by giving statutory force to the codes of good conduct and good practice which are now attainable.

In the Bill, which replaces the existing code of the relevant part of the Public Health Act, 1936, the guiding principle throughout has been enforceability. Both the House, which gave the Bill a Second Reading, and the Standing Committee, which considered it in detail, were agreed that nothing should be put into it which could not and would not be enforced. Such a Measure as this would fail if its provisions were not in every respect practicable and if, therefore, the courts or the local authorities—or, what matters in the last resort, public opinion—did not support enforcement.

We have, therefore, sought to avoid some of the characteristic faults of the code of 1936, with its large prohibitions and its large avenues of escape and the dependence of that code on the concept of nuisance. Instead, the Bill has proceeded by the method of dividing the whole sphere of pollution of the air into its various sectors and imposing requirements which were appropriate to each of them.

In three of those sectors, full-scale prohibition will be enforced. The emission of dark smoke, not only from furnaces and chimneys, but also from railway engines and from vessels in ports and harbours, becomes an offence *per se*, and the purpose of such temporary or exceptional defences as are expressly defined in the Bill is to render enforcement everywhere else the more certain and easy. Our old familiar friend the " best practicable means " defence of 1936 has gone in regard to dark smoke.

For all new furnaces with substantial rates of fuel consumption or which burn pulverized fuel, equipment to prevent grit and dust emission is an absolute requirement. In this direction too, the ifs and buts have gone.

Finally, in the smoke control areas which will be established on local authority initiative under the provisions of Clause 9, the emission of smoke will itself be an offence. Here, too, such few and narrow exceptions as are provided for are intended to have the means of facilitating and tightening enforcement. In this connection, it is fitting that once again, as has happened so often throughout the proceedings on the Bill, a tribute should be paid to the pioneer work of the authorities which have had smokeless zones under local Acts and have successfully operated them. Outside these three sectors, absolute prohibition would have been inconsistent with the principle of enforceability.

In regard to the emission of light smoke, if I may coin that expression to describe what is not dark smoke, the

Bill requires that all new furnaces shall be as far as practicable smokeless and that the emission of grit and dust from both new and existing furnaces shall be reduced to a minimum. It also takes the opportunity, where the nuisance provisions of the 1936 Act still apply, to simplify and facilitate prosecutions under that Act. Sheer technical practicability has also dictated the provisions of Clause 15, which deal with the problem of children of air pollution, those processes of the kind listed in paragraph 99 of the Beaver Report. Without entering again into our long controversies on the subject of Clause 15, we shall, I think, all agree that a means has to be found for keeping an eye on these problem children for so long as they require that treatment, and that co-operation between an expanded Alkali Inspectorate and the local authorities is the best tutelage to which to entrust them. As soon as technique permits in the case of any particular process, that process must be taken out of Clause 15 and dealt with under the other provisions of the Act.

Thus for enforceability's sake, the Bill combines requirements of varying strictness in varying circumstances; but I believe its whole tendency will be to promote a rise in standards everywhere, to intensify public interest in the prevention of air pollution, and to direct the work of science and technology into the solution of the problems which are still outstanding.

Dr. Summerskill: I have pleasure in following the Parliamentary Secretary. I think that those of us here who found the thirteen weeks of Committee work at times perhaps a little tedious were sustained always by the knowledge that we were playing our part in promoting a Measure which will, I think, be regarded by those who are interested in public health as a most important addition to the public health law.

We have been involved in all kinds of technicalities, and I do not think it would be wrong to say that at times both sides felt somewhat bemused and bewildered. Nevertheless, we have struggled on, and now that we have come to the end I feel a tremendous satisfaction in thinking that I have played some part in bringing the Bill to Third Reading. I like to think that I have stood both at that Box and at this Box to assist in the passage of Measures to help ensure that we have clean food, clean milk, and now clean air.

Mr. Blenkinsop: And clean water, too.

Dr. Summerskill: I missed that, but I have been trying to think of other things we can clean, too.

This is an important Bill, and here I must say a word about the hon. Member for Kidderminster (Mr. Nabarro), for I think we have seen him at his best during the passage of the Bill, and I am sure all of us have welcomed the contributions he has made to our deliberations.

I have been a little sorry for the experts. I assume that many of them have been following our debates. So many of them have been confounded. I must comment again that it is extraordinary that so many experts who have given advice on this subject have proved to be wrong. It is a most curious thing that so many of them apparently have devoted all their academic lives to the subject only to hear amateurs like us deriding them. They must find that a little difficult. The outstanding case was the Amendment which we recently discussed whereby " ten tons " had to be changed to " one ton."

Mr. Nabarro: At the outset, I should like to thank my hon. Friend the Parliamentary Secretary to the Ministry of Housing and Local Government and the right hon. Lady the Member for Warrington (Dr. Summerskill) for the references made to our combined activities during the course of the last 18 months. It is almost without parallel in parliamentary fortunes that a Private Member should have won first place in a Ballot for Private Members' Bills within three weeks of

publication of the voluminous report of a Committee established by the Government, namely, the Beaver Committee Report, on this issue.

The fact that I was privileged to bring in a Private Member's Measure was due largely to the advice of my hon. Friend the Member for Wolverhampton, South-West (Mr. Powell), who happens now to be the Parliamentary Secretary, assisting in the piloting of this Measure, for at the time he gave admirable advice in the drafting of what was a most complex Bill. Undoubtedly, no Private Member's Measure of that kind could have begun to succeed without the co-operation of the other side of the House, and the fact that we succeeded on 4th February, 1955, in securing the cognisance and support of Her Majesty's Government for the ensuing legislative Measure of a similar kind, was in no small degree due to the support of hon. Members opposite. In fact, the success of ensuing events could not have been achieved without their help.

I must say, however, that I am not entirely satisfied with the Bill in its present form. The Parliamentary Secretary has wisely observed that the co-operative efforts of many agencies will clearly be required before any full implementation of the policy of clean air can be achieved in this country. We shall require the co-operation of industry, both private and nationalized. We shall require the co-operation of the local authorities, of private persons dwelling in houses in various parts of the country, of Her Majesty's Government, and of many bodies and agencies which, by their co-operative effort, can achieve what we all have in mind and in view.

The trouble with a somewhat abstract matter of this kind, is that while all piously pay lip service to the desirability for a policy of clean air, the individual person and the individual firm are often less than anxious to make their own personal contribution towards the success of the policy. I use those words with due care and prudence.

In fact I find, amongst people with whom I have talked on this important topic, a good deal of scepticism about the prospects of securing really clean air in what the Beaver Committee referred to as the black areas of the country, notably the heavily industrialized areas. The sceptical folk are inclined to say that they and their forebears have endured since the earliest days of the Industrial Revolution, heavy smoke in all the industrial districts, and that it seems hardly practicable for those areas to be rendered free from smoke.

Mr. R. E. Winterbottom: I am almost at a loss for words. With the hon. Member for Kidderminster (Mr. Nabarro) recanting and everybody praising everybody else or sitting at the mercy seat, it is rather difficult for me to express that inward glow of satisfaction that I am an unredeemed sinner. I have gloried in this Bill: I have enjoyed it right from the beginning because I have tried—although I fear that I have failed—to make it a really effective Clean Air Bill.

The Government have produced a Parliamentary Secretary who has argued the Bill in a very good way. I congratulate him on his performance, but the Bill is still a bad one. For thirteen Committee sittings and two full days in this House we have been sailing towards the horizon of clean air, with our engines full astern and our flag half-way up the mast. In that mixed metaphor I am saying that I am still very unsatisfied with this Bill.

The Parliamentary Secretary said that we have done very well with the Bill and have said that the " best practical means "—one of the phrases used in the courts for a long time under the Public Health Act—has now gone and that there are now no " ifs " and " buts." There are some " ifs " and " buts " in these defence provisions. A great many lawyers will soon enrich themselves by trying to find ways and means of applying defence provisions and opposing defence provisions. It has been wrong to include in the Bill those defence provisions which will be used, I am con-

vinced, as a means of escape to avoid doing what is right and proper, in terms of equipment, to free the air from the noxious poisons from which not only people but the economic condition of the country suffer.

With the Parliamentary Secretary, I hope that this is not the last Clean Air Bill. I should be very sorry if I thought that, except for what happens in another place, our legislation for clean air was virtually finished here tonight. I do not believe that even the Beaver Committee went as far as it could have done in its recommendations to improve the health of the country and equipment, so that it would make its full contribution to the nation's economic well-being. The Beaver Committee could have spent more time in Sheffield. By going into various places in the city it could have learned far more than it did from its brief visit there.

We have put one or two teeth into the Bill and we have slightly improved it, but we have given it nothing like a full set of dentures.

Dr. Stross: All of us, on both sides, have found the transactions of the Bill during Committee quite fascinating. To a medical man like myself, it has appeared throughout not as a piece of normal legislation connected with industry, but as a piece of preventive medicine, and a very important and exciting piece. I am sorry that my hon. Friend the Member for Brightside (Mr. R. E. Winterbottom) feels as pessimistic as he does. His advice was so very valuable during the Committee stage, but I am quite sure he is mistaken in thinking that very little has been done by this piece of legislation.

The real parents of this Bill, of course, were misery and death, to say nothing of squalor and disease. A few years ago we had the great fog, which cost us so many thousands of lives in Greater London; and the House will perhaps have noted that this last winter a further thousand people died as a result of what is called " smog " in London itself, as compared with the normal year.

It is that which has forced this legislation upon us. The fact that we have had to wait so long should not make us too ashamed, for is it not the first piece of comprehensive, national legislation of its kind in the world? In saying that it is comprehensive and national in character, I believe that it has gone as far as, if not further than, anything else on a national scale anywhere in the world. There have been other fragments of legislation, state by state or city by city, some perhaps a little more comprehensive than this. This, however, is national legislation, and I do not at all object that the Minister should boast of his child when he goes abroad and commends it to other countries. I am sure he is absolutely right to do so, and we, too, are all proud of it.

Mr. Sandys: First, I would refer to the speech made by the hon. Member for Stoke - on - Trent, Central (Dr. Stross), who said I should be proud of the paternity of my child. Nowadays, personal leadership is out of fashion. Collective leadership is the order of the day. I think we can all agree that this Bill represents a collective effort, and that we can all join in paying tribute to the collective paternity of the child. (*Laughter*). If the doctors on the opposite benches object medically to that description, I can only say it was not intended in that sense.

This is not the first time that Parliament has enacted legislation to deal with air pollution, nor, I am sure, is it going to be the last. Nevertheless, I think that we can claim that this is far and away the most comprehensive Measure yet introduced on this subject. If hon. Members glance at the Fourth Schedule of the Bill, they will see that it repeals all or part of twelve Acts and replaces them by a suitable code which establishes for the first time a comprehensive control of smoke, grit and dust from all sources, including domestic chimneys.

An encouraging feature about the whole of our proceedings has been the wide support which this policy has

evoked not only in the House but among all concerned outside. This fact has emerged clearly from my consultations with local authorities, with industry and others, and, as is evident from their speeches, from the contacts which hon. Members have made in their own constituencies with local authorities and with industry and expert bodies. The same warm support has been evident throughout in the House. Sometimes it has been a trifle too warm, but that is obviously a fault on the right side.

On Second Reading, I said that I did not want what I described as "watered-down clean air." I went on to say—

> " . . . I am prepared to consider any advice and proposals which may be offered in Committee . . . to make the Bill as effective, tight and strong as possible consistent with what is practicable."—(*Official Report*, 3rd November, 1955; Vol. 545, c. 1330).

I hope that the House feels that I have done my best to implement that undertaking. Some hon. Members no doubt would have liked the Bill to have been a trifle stricter at certain places. My hon. Friend the Member for Heywood and Royton (Mr. Leavey) quite fairly said that the Bill represented a reasonable compromise between what is desirable and what is practicable.

I am sure that all would agree that in any case the success of the Bill will not depend upon prosecutions and penalties. It will depend finally upon the sincere belief of local authorities and industry and the general public in the policy of clean air and their determination to see it through. Personally I am confident that this belief and this enthusiasm will be forthcoming and that we shall have the hearty co-operation of all who are concerned with this policy. As new discoveries are made, new Bills will have to be passed to translate them into legislation, but we should not underrate the significance of the step that we are now taking.

Belfast Meeting on Smoke Prevention

According to a report in the *Northern Whig*, a public meeting to focus attention on the importance of preventing atmospheric pollution was held in Belfast on 20th March, under the auspices of the Northern Ireland branch of the Society of Medical Officers of Health and the Northern Ireland section of the Sanitary Inspectors' Association. The speakers were Dr. J. M. A. Taggart, deputy medical officer of health, Belfast; Mr. J. Graham, chief sanitary inspector, Manchester, and Mr. K. Higginson, Northern Ireland area engineer, N.I.F.E.S. Dr. F. F. Main, chief medical officer, Ministry of Health and Local Government, presided.

Maintenance of Road Transport Engines

In a paper read before the Diesel Engineers and Users Association on 15th March, Mr. A. T. Wilford, director of research, London Transport Executive, described the causes of objectionable exhaust smoke and the action which must be taken by users if this nuisance is to be suppressed. " Emission of objectionable exhaust smoke can be avoided," said Mr. Wilford, " firstly, by ensuring that the engine maker's recommended setting for the fuel-injection pump is not exceeded, and, secondly, by adopting a proper system of inspection and maintenance of the engine and fuel-injection equipment."

Mr. Wilford emphasized, however, that a setting which gives the rated power output, together with exhaust, " virtually free from carbon monoxide with little more than a haze of smoke," must leave small margin for variations which can occur during the period between inspections. It is for this reason—as the author stated—that the majority of operators of public service vehicles, including London Transport, prefer to employ " a setting which is lower than that recommended and has the effect of derating the engines by about 10 per cent."

Transport and Electricity

The Electrical Power Convention

This year's British Electrical Power Convention, held from 23rd to 29th May at Torquay, had for its theme the uses of electricity in transport, both road and rail. Frequently mentioned in the papers, and still more implicit in them, was the contribution that electrification can make towards the implementation of the clean air policy. As Sir John Dalton, the Convention President, pointed out, the convention is unique among industrial conferences as it is the only case of its kind " where a vast nationalized industry and a vast private enterprise manufacturing industry meet together to debate common problems of national importance."

In a paper on " Electricity in Rail Transportation," Mr. S. B. Warder, the Chief Electrical Engineer of British Railways, spoke of the slow infiltration of the art of the electrical engineer upon railways in general and on railways in Britain in particular. After a brief historical review Mr. Warder spoke of various developments and the part they had played in leading to the merging of the best features of A.C. and D.C. systems into a new form of electric traction.

He then devoted the main part of his paper to a description of the new system of traction at the standard frequency which the British Transport Commission have decided to adopt as the standard system for the United Kingdom, giving reasons leading to its choice. The electrification of the main lines of British Railways forms a major part of the Transport Commission's £1,200 million modernization plan.

Mr. C. M. Cock, of the English Electric Co., in a paper entitled " Electricity in Locomotives," said that electric and thermo-electric locomotives are now a large factor in rail transport and that their use is extending on the railways of the world. He made reference to the economics of diesel and gas turbine locomotives as self-contained units but said that he had not made an economic assessment on electric locomotives because this must include the fixed equipment for the supply of electrical energy and was outside the scope of his paper.

Today, the multiple-unit electric train is being used by all the principal railways of the world for suburban services, stated Mr. F. A. Manley, of G.E.C., in his paper on " Electric Multiple-Unit Trains and Equipment." Among its characteristics were high acceleration, maximum passenger capacity and ready adjustment to varying traffic demands. Lengthening a train of this type did not detract from its performance, as each unit provided its own motive power, while trains may be divided at junctions and the separated sections proceed to different destinations under their own power.

Multiple-unit trains operating on relatively long-distance services with infrequent stops combined high acceleration with high maximum running speed. The new trains for the Liverpool Street-Southend electrification will attain a maximum of 68 m.p.h. on the average section between stops, and will achieve an average overall speed, including station stops averaging 30 sec., of 41·5 m.p.h.

In their paper " Electricity Supply and the Railway Load," Mr. F. J. Lane and Mr. W. B. Noddings, of the Central Electricity Authority, discussed the effect of the development of railway electrification on the national system. They showed that the additional maximum demand to be expected from the railway load was small when compared both with the present demand on the national system and with the expected general growth. On the other hand, while the

diversity between the present largely suburban railway traction load and the general system load is small, main line electrification gives prospect of a greater measure of diversity and an improvement in system load factor which would be welcome.

Road Vehicles

Of particular interest in view of widespread doubts concerning air pollution from road vehicles, was a paper by Mr. J. H. Cansdale, of B.T.H., on " Passenger Electric Road Vehicles." After saying that the problem of air pollution was becoming increasingly serious as the number of internal combustion engined vehicles increased and the average speed of city traffic was reduced, Mr. Cansdale said that the claims of electrically-driven vehicles must be re-examined. He deplored the present general policy in Britain of using diesel buses for all purposes, which was in contrast to the present tendency on the continent and in the U.S.A.

Mr. Cansdale went on to say that although now out of favour in Britain the tramcar was still extensively used elsewhere. In its modern form it was a fast, quiet, comfortable and economic vehicle, which could carry heavy traffic with much less road congestion than buses. Tramways still had a most important part to play as a form of transport intermediate between the electric railway and the bus. It could also be used on inter-urban routes where private rights of way permit it to run as a light railway.

For traffic which was not heavy enough to justify the expense of rails as well as overhead, the trolleybus claimed a useful sphere in which it offered many advantages over the motor bus. Its smooth but rapid acceleration, its quiet and fumeless operation, made it an ideal vehicle for city traffic of minimum density. In various forms with single or double deck bodies it was used all over the world and was a favourite with the travelling public. A new form of electric vehicle, the gyrobus, had recently been tried out on a small scale. It offered interesting possibilities for special applications but was unlikely to have as wide a field as trolleybuses and trams.

Mr. V. W. Dale, Vice-Chairman of the Electric Vehicle Association, presented another interesting paper on " Battery Electric Vehicles." After speaking of the economic advantages of electric battery vehicles for delivery work, Mr. Dale enumerated some of their other advantages including: long trouble-free life; silence; no fuel consumption when standing; and most important from this journal's point of view, freedom from fumes, oil and engine dirt.

Liverpool Firm Fined on Black Smoke Charge

The first post-war prosecution for excessive emission of factory smoke in Liverpool was heard recently. The defendants, a firm of produce merchants, were fined £5 after pleading guilty to a summons alleging that, due to bad firing, a chimney at their factory had created a nuisance by emitting black smoke.

Making an order prohibiting recurrence of the nuisance, the magistrate said that two of the three stokers mentioned in the case had apparently given up the job because of criticism. The third was a marine stoker accustomed to dealing with oil-fired boilers. The prosecution said that on 13th September 1955, Mr. J. Rimmer, the Corporation's senior smoke abatement officer, saw an emission of black smoke from the chimney, lasting 7½ minutes, and he issued an abatement notice under the Public Health Act, 1936.

On 12th January, 1956, the chief sanitary inspector, Mr. W. H. Wattleworth, kept the chimney under observation for 30 minutes. During that time dense black smoke was emitted for an aggregate of 8 minutes.

For the defendants it was said that the boiler was perfectly satisfactory provided it was properly and carefully stoked. The difficulty was to get good reliable stokers. One of the firemen admitted that he had not been stoking the boiler the way he had been shown.

NEWS

Tracing Air Pollutants

A method of using special smoke to trace paths of pollutants in the atmosphere was described by Dr. Frederick G. Sawyer and William H. Shallenberger in a paper given at the national meeting of the American Institute of Chemical Engineers in Los Angeles, 26th to 29th February.

The tracer material, finely divided zinc-cadmium, was fed into a stack which dispersed it into the air. Sampler devices located downwind sucked in the air bearing the tracer smoke, particles of which were identified by ultra-violet rays. By counting the number of particles collected per unit time, the concentration could be determined.

In concluding, Dr. Sawyer stated, " The tracer technique is no panacea, but it is the best available means for determining air movements and effluent concentration downwind from an emission source. As such, it is a valuable tool in air pollution abatement programmes."

International Spread of Air Pollution

A correspondent to the *Coventry Evening Telegraph* of 18th April wrote that there are signs that atmospheric pollution is becoming an international problem.

" In Arctic regions," he continued, " a thin layer of fine ash particles has been found in some areas, lying on the snow, having been blown by the winds from various industrial areas several thousand miles away. Nearer home, a few weeks ago the aeronautical press reported that the Irish Air Lines, Aer Lingus, were introducing a new colour scheme for their air liners, with dark green paint on surfaces formerly painted white, due to the earlier colour scheme showing in a short time the dirt picked up when operating regular services into British industrial areas such as Birmingham."

First Smokeless Zone Fine

In what is believed to be the first prosecution of its kind in the country, a thirty-one-year-old Pole, Josef Niewiara, was fined 10s. at Bolton on 28th February for allowing smoke to emit from his house in the town's 86 acre smokeless zone. Mr. C. D. Brewer, prosecuting for the Corporation, said that sanitary inspectors had visited all the premises in the area and advised occupiers, told them of the requirements and offered advice on the fitting of smokeless grates and the supply of smokeless fuels. Three times in February, 1955, an inspector saw smoke coming from Niewiara's house in Bark Street, Bolton, and told Niewiara's wife.

Twice the inspector saw coal being burned on the fire. As a result Niewiara was written to and told that if he wanted any advice on the burning of smokeless fuel or any other matter the chief sanitary inspector would be happy to get in touch with him. Mr. Brewer described how Niewiara applied for and received a grant towards the cost of a grate he had already installed under the Town Council's financial aid scheme for the conversion of old-type grates to ones which would burn smokeless fuel.

On 14th January this year, added Mr. Brewer, the same inspector noticed a heavy smoke emission from Niewiara's house and saw a coal fire burning in the living room, and on 21st January, when he again saw smoke coming from the house.

Stressing that the Corporation had sought to be as co-operative and lenient as possible, Mr. Brewer said: " If the order is to be worked at all and not to be made useless, it must be enforced."

Smokeless Zone Criticisms Answered

Councillor Hutchinson, chairman of Bolton Health Committee, recently made a statement replying to a leading article in a local paper on Bolton's smokeless zone. In the statement he answered criticisms about the exemptions which have been made locally.

As reported in the same newspaper, Councillor Hutchinson stated:

" I wish to make it quite clear that exhaustive measures have been taken by the Medical Officer of Health to ensure that every occupier of premises within the smokeless zone should be aware of the legal requirements and should also know where to apply for technical assistance and, if need be, financial assistance where appropriate. Circulars were issued on two separate dates giving full information on this matter. In addition, many visits have been made by sanitary inspectors both before and since the date upon which the Order became operative. This is confirmed by the facts. The only complaints made have been confined to a small area and every complainant has been visited and assisted by one of the senior inspectors in the Health Department.

" Up to date £641 has been granted by the Corporation in the shape of financial assistance to help occupiers of dwelling houses to convert unsuitable appliances to firegrates and cookers of an approved pattern capable of operating smokelessly.

" Whenever a contravention of the Order has been observed, the occupier has been given advice. In some cases, warnings have been given repeatedly, and only in the last resort has it been considered necessary to take stringent measures."

Threat to Ontario's Health

Air pollution, which has become a major problem in many southern Ontario cities, is causing serious injury to both physical and mental health, according to the interim report of a select committee.

The report, which has been tabled in the Ontario legislature, says that air pollution is costing Toronto alone $60m. a year, and the whole province probably double that amount, and that it is probably the main cause of lung cancer, and other respiratory diseases which are becoming alarmingly prevalent in Toronto and other cities. " The old-fashioned idea was that a smoking chimney was a sign of a full lunch pail and prosperity, but today it is an indication of waste and bad manners and a source of unnecessary dirt."

The committee recommends legislation enabling municipalities to control air pollution, particularly from railways and shipping; a study of pollution from motor exhausts; and the setting up of an agency to gather technical information and give advice.

About 70 per cent. of the pollution in Toronto comes from industrial sources and the rest from motor vehicles.

Give Coke a New Name

Speaking at a discussion on coke held in Bristol on 18th April, Mr. F. J. Redstone, the chief sanitary inspector of Bristol, and chairman of the Society's Executive Council, said: "At the present time there is little imagination in the name of this fuel. It is not attractive to the consumer and the gas industry may well think up a new trade name more in line with modern technique."

Smokeless Zone Plan Deferred

Felling Council, Co. Durham, have had to abandon the scheme which they had hoped would enable them to be the first local authority on Tyneside to create a smokeless zone on new housing estates. It was stated that Gateshead Council, a neighbouring authority, were not prepared to follow their example of inserting a tenancy clause in respect of a housing estate providing that only smokeless fuel should be used. Other reasons for the Council's decision were that no arrangement appeared to have been made between the miner's lodges and the National Coal Board for the supply of smokeless fuel as concessionary coal or bought coal, and it had not been possible to convince the majority of tenants that smokeless fuels were cheaper and more efficient.

The Council are to reconsider the matter when Parliament has dealt with the Clean Air Bill.

New Catalytic Muffler for Exhaust Gases

Oxy-Catalyst, Inc., of Wayne, Pa., U.S.A., has announced a new catalytic muffler for use on industrial vehicles using leaded petrol. The Oxy-Muffler uses a pellet-type catalyst that resists lead contamination and is reported to eliminate as much as 90 per cent. of exhaust carbon monoxide, aldehydes, and hydrocarbons. Gases from the engine exhaust manifold enter the muffler through a venturi section containing an air-inlet filter and flow down through beds of catalytic pellets where contaminants are burned. The cleaned exhaust gases leave through an outlet pipe. The catalyst pellets may be replaced when necessary through removable ports.

The units now being produced are designed for fork-lift trucks, power sweepers, and various materials handling equipment, but Oxy-Catalyst is now working with automotive specialists on specific designs for practical catalytic mufflers for cars, lorries and buses. It is reported that shortcomings in design and structural strength of the muffler, shown up in recent tests, have been overcome.

Operation of the engine under load or at high speed idling for 3 or 5 minutes is sufficient to bring the catalyst up to operating temperature. The company's tests indicate that the muffler will provide at least 90 per cent. clean-up for at least 600 operating hours, the equivalent of 5 months of lift truck performance in some factories. All parts of the muffler that come in contact with exhaust gases are made of stainless steel.

Device to Prevent Diesel Smoke

Effective steps are being taken by Leyland Motors, Ltd. to prevent drivers from unnecessarily operating the excess fuel device on diesel buses and lorries in order to obtain a boost from the engine. In future all Leyland diesel engines will be equipped with fuel-injection pumps that incorporate a new manually-operated excess fuel device of the baulking type. To operate it, the driver will have to leave his driving seat. Although the device supplies excess fuel to a cold engine, and continues to do so while the throttle is held open, the supply immediately returns to normal when the throttle is momentarily closed. Abuse, such as attempting to fix the device in the excess fuel position, results only in a smaller supply of fuel than normal.

Electricity in the Smokeless Age

At the annual conference of the Electrical Development Association in April last, a paper was read on " The Place of Electricity in a Smokeless Age," by Philip Honey, A.M.I.E.E. The paper surveyed the pollution problem, the Beaver report, and the clean air legislation in some detail, and then discussed the part to be played by electricity in smoke control areas.

Of particular interest were Mr. Honey's references to the possibility of an electric firelighter. Such devices have been developed before but have not so far been successful, largely because of the ease with which they burn out if left in the fire too long. Tests have shown that this difficulty can be overcome if the firelighter is laid on the clean bars of the grate, with the fuel above it. The temperature does not then reach a dangerous level, possibly because of the cooling effect of the air being drawn in through the bars. A firelighter working on this principle, and fitted with a thermostat, is now on the market.

Stockport Consultative Advisory Committee

Stockport Health Committee is to set up a consultative advisory committee for smoke abatement. Bodies to be invited to be represented include the Stockport Standing Conference of Women's Organizations, Stockport Chambers of Trade and Commerce, the Master Builders' Federation, the Trades Council, the Stockport and Buxton Hospital Management Committee, the Railway Executive, and the Ministry of Fuel and Power.

CLEAN AIR: THE DUTIES OF SANITARY INSPECTORS AND LOCAL AUTHORITIES

Excerpts from a Paper to the Royal Society of Health at its Blackpool Congress, April, 1956

by

A. C. Saword, D.P.A., F.S.I.A., F.R.S.H.

Chief Sanitary Inspector, Kingston-upon-Hull

The Sanitary Officers Regulations require that a sanitary inspector shall

> ". . . by inspection of his district both systematically and at intervals as occasion requires, keep himself informed of the sanitary circumstances of the district, and in respect of the nuisances therein that require abatement."

In the case of atmospheric pollution, an inspector obtains his information in various ways. He usually resides in the district and is in daily contact with local ratepayers, councillors and other officials. If he is the sole inspector for a small urban district he will be personally aware of every troublesome chimney within the area of his authority. On the other hand, if he is the chief inspector for a large city, he will have that city divided into a sufficient number of small districts, with an inspector responsible for each and reporting to him anything which requires his attention. These inspectors traverse the length and breadth of their districts almost daily and are in contact with many of the residents, so very few smoke nuisances are likely to escape their notice. In addition, most large towns will have one or more inspectors specializing in smoke abatement, although in some cases they may couple such work with the control of offensive trades or factories inspection.

Information as to the general state of the atmosphere is also obtained by means of petri dish surveys, deposit gauges, automatic or daily smoke filters, and volumetric apparatus or lead peroxide cylinders for the estimation of sulphur dioxide in the air.

I have mentioned these well-known facts, partly for the information of those outside the local government service and partly because I wish to refer to certain statistics which first appeared in a Ministry of Health Report[1] and were then quoted in the Beaver Report. Sir Hugh Beaver has also made particular reference to them on several occasions since the publication of his report. These statistics, which showed that only 1·3 per cent. of the total time of all sanitary inspectors was spent on smoke abatement, were calculated on replies to a questionnaire filled in by 4,500 inspectors in cities, urban and rural districts. The questionnaire required each inspector to state how much his time was divided between various duties, grouped under 24 headings. Such an assessment by no means indicates the true position.

Some people have suggested that the only way to control atmospheric pollution is to appoint specialist

[1] Ministry of Health (1953). *Report of the Working Party on the Recruitment, Training and Qualifications of Sanitary Inspectors.* H.M.S.O., 29.

inspectors on either a national or regional basis. I think that is a mistaken idea. If one wished to calculate the relative amount of coverage afforded by the two systems, it would be necessary to show, on the one hand, 1·3 per cent. of the time of 4,500 sanitary inspectors spent *primarily* on smoke abatement, plus the time in which they are noting atmospheric conditions while going about their district on other work, plus all the information and complaints received from local people with whom their work brings them in daily contact, plus the time spent noticing smoky chimneys in off-duty hours by inspectors who live on their districts, etc. On the other hand, it would be necessary to begin with a relatively small group of inspectors devoting 100 per cent. of their working hours to this one task. They would be spread very thinly about the country and there would be no additions to their side of the equation: instead there would be deductions for time spent travelling from residences to remote districts, and time wasted due to lack of local knowledge as to which chimneys are likely offenders and which never offend.

The amount of time which sanitary inspectors have in the past spent on formal action against smoke nuisances must also be considered in the light of past legislation and national conditions with regard to fuel and boiler plant. Bearing in mind the conditions which prevailed for some years after the war, together with Government policy which actively discouraged the making of smoke byelaws and placed a restraining hand on any local authority contemplating legal proceedings, the fact must be recognized that if more time had been spent on *formal* smoke observations, much of that time would have been wasted.

Throughout his numerous and varied duties, the sanitary inspector of today depends largely upon informal action for securing desired improvements. He fully realizes that the majority of citizens are willing to comply with the law provided its meaning and purpose are made clear. He also knows that in each unit of local government, the electors, the elected representatives and the officers are all very close together and interdependent. An officer cannot successfully pursue a progressive policy unless his council is wholeheartedly behind him, and the council, in turn, cannot go far without the support of the majority of electors. Health education is therefore a necessity if the wheels of administration are to run smoothly. Exhibitions, lectures, films, pamphlets and personal interviews each have their place in any well-organized campaign.

One of the results of the numerous committees set up by the Government to investigate this subject is that they have left behind a mass of information which has been supplemented by bodies such as the National Smoke Abatement Society and the Department of Scientific and Industrial Research until the case against smoke is overwhelming.

Much has been made of the fact that smoke knows no boundaries. That is perfectly true: it is equally true that it can be dealt with only at the place of production. Local inspectors, working and living in the district, have the most constant and complete knowledge of all local sources of pollution, and that knowledge must be utilized fully if the problem of atmospheric pollution is to be overcome. The general district sanitary inspector cannot be an expert in combustion engineering and in all the other subjects and sciences with which he is concerned, nor is it necessary that he should be: he is primarily an inspector and his first duty is to keep himself and his authority informed concerning any local contraventions of the various statutes, byelaws and regulations falling within his province. No other officer could carry out that duty more efficiently and economically. He also endeavours, by friendly advice and informal action, to prevent contraventions arising, and here his local know-

Concluded, page 266

SMOKE PREVENTION ABSTRACTS

247. The Chemist and Air Pollution. G. Nonhebel. (R. Inst. Chem. J. **80**, 64-67, 1956). Possible lines of research are suggested, through which chemists can contribute to the effectiveness of the Clean Air Act. This can be partly carried out by applying new knowledge and techniques to existing chemical processes and by using different methods of manufacture for existing chemicals. But a wider responsibility is needed to improve combustion processes. Suggested lines of approach: development of cheaper processes for the removal of volatile matter from non-caking coals; improvement and cheapening of mechanical stokers; study of heat transfer and atmosphere required by heat-treatment of steel and production of blue bricks; development of steel-making processes which do not create iron-oxide fumes; of methods of monitoring the dust and grit that escapes from industrial collectors; of an economic process for the production of sulphuric acid from flue gases; and the measurement and identification of the constituents of atmospheric pollution, particularly carcinogens.

248. The Mechanical Firing of Boilers. D. C. Gunn. (Combustion Engng. Assoc. Proc. Scot. Sect. Meet. Glasgow, 1955 (March 22), 17-26). The differences between underfeed and overfeed firing of coal are set out, and the reasons for heavy smoke formation with the latter method, for example with sprinkler stokers, are given. Chain-grate stokers, the main representative of the underfeed method, are not likely to cause smoke formation if correctly handled. This also involves proper moistening of the fuel, particularly if it contains a large amount of fines, avoiding any disturbance of the fuel bed, installing grit arrestors and, in shell-type boilers, installing baffles to mix the stratified gases. An essential item in fuel efficiency is control of combustion; automatic control instruments are available for every type of boiler and firing appliance and their costs are small compared with the savings they are able to effect. (B.C.U.R.A.).

249. The Determination of the Amount and Distribution of Atmospheric Smoke Pollution by Analysis of Snow. J. A. S. Gilbert and A. J. Lindsey. (Chem. and Ind., 1955 (Nov. 5), 1439-40). It had previously (B.C.U.R.A. Abstract 7337, 1954) been shown that the amount of pyrene in the atmosphere gives a measure of the degree of smoke pollution. Samples of fallen snow were therefore collected in and around London, and the pyrene in each sample was determined by extracting it with chloroform, dissolving this extract in n-hexane, and measuring the intensity of the absorption peak at 3 350 Å. The concentration of pyrene was found to range from $0{\cdot}2\mu$ g/l. of water in the snow taken from rural places up to $0{\cdot}9\mu$ g/l. in the snow from certain places that are severely affected by smoke emitted mainly from domestic chimneys. (B.C.U.R.A.)

250. A Simple Vane Cyclone Separator. G. D. Joglekar and N. R. Subramanian. (J.Sci. Ind. Res., 1955, **14A** (Sept.), 419-26). Two cyclones were constructed with a vertical vane at the point where the tangential inlet duct touches the circumference of the cyclone body, the main difference between the cyclones being the size of the outlet pipe (12 in. and 6 in.). The vane can be turned to any position between tangential and radial and this determines the size at which separation takes place in the cyclone. The shape of the separation curve depends on the original size distribution of the material. The vane is equally effective in low and high velocity cyclones. (B.C.U.R.A.).

251. Recovery of Fly Ash by Electrostatic Precipitation. Research Corporation, C. W. J. Hedberg and H. A. Wintermute. (Brit. Pat. 737, 368. Appl. date 21st December, 1953). The efficiency of an electrostatic precipitator for cleaning the flue gases from a pulverized-coal-fired boiler is increased by adding to the uncleaned flue gas pulverized coal of less than 10μ size and in an amount of 10-20 per cent. of the total weight of fly ash. The coal is added at a point where the flue-gas temperature is below the decomposition temperature of the coal. The coal is obtained by passing part of the coal from the pulverizer through a cyclone, returning the coarse fraction to the pulverizer circuit and adding the fine fraction to the flue gas. (B.C.U.R.A.).

252. Investigations of the Sulphur Dioxide Content of Air near the Ground in the Neighbourhood of Power Stations Burning Bituminous Coal. H. Stratman. (Mitt. V.G.B., No. 37, 1955 (Aug.), 705-14. In German). The difficulties of theoretical estimates are discussed, and the method developed for measuring the concentration near two power stations is outlined. The results are given in tables and graphs and are compared with values calculated from Sutton's and Bosanquet's equations. The maximum concentrations were found at distances between 1,000 and 2,000 m from the stations and were independent of the chimney emission and chimney; the average was 0·2mg SO_2/m^3 air and reached, in the winter months (fog), values of 0·5—1 mg/m^3 but never exceeded 1 mg/m^3. The agreement between actual and calculated values is fair, but the calculated values are too high at low wind velocities and in highly-populated regions. (B.C.U.R.A.).

253. Measurements of Dust Deposition in the Neighbourhood of a Large Power Station Burning Bituminous Coal. K. Ost and G. Mirisch. (Mitt. V.G.B., No. 37, 1955 (Aug.), 689-700. In German). The dust deposition was measured in the area around the Scholven power station which has eight pulverized-fuel-fired boilers, some with wet and some with dry bottom furnaces, three boilers with Martin stokers and one with a travelling-grate stoker, the four latter boilers being reserves. No dust separators are installed, but the two main chimneys are 150 m. (450 ft.) and one other chimney 100 m. (300 ft.) high. Dust deposition exceeding 1 g/m^2 per day was measured in the main wind direction S.W. to N.E. up to 5 km. distance, in two other directions up to 1 km., and in a fourth direction not at all. The background dust content of the air gave a deposition of 0·7 g/m^2 per day and the results were also greatly influenced by other dust sources. The dust emission of the power station is therefore not regarded as dangerous; in addition, the Ca in the dust neutralizes the acid deposits caused by the SO_2 contained in the flue gas, and other investigators have shown that the dust does not accumulate but is incorporated in the soil and actually promotes plant growth. (B.C.U.R.A.).

254. Problems of Preventing Smoke Damage from Furnaces. Boie, W. (Energietechnik, Nov., 1955, **5**, 498-506). The author considers in some detail various approaches to the problem of preventing sulphur pollution, viz.: the removal of sulphur by water washing and other washing techniques; the construction of special stacks aimed at creating maximum dilution; the removal of sulphur before burning the coal. The nature of the occurrence of sulphur in coal and its behaviour during combustion are examined, and some tests were conducted to gain information on the proportion of sulphur combined in the ash and that volatilized when different coals were burned. The merits and demerits of various standard types of flue gas cleaning equipment are discussed, and the effect of cyclone firing on sulphur emission is mentioned as a problem requiring fresh study. (D.S.I.R.).

255. Recommended Standard Method for Continuing Dustfall Survey (APM 1-a). Air Pollution Control Association (J. Air Poll. Con. Ass., Nov., 1955, **5**, 176-180). The method applies to the measurement of average rate of dustfall over a large area, the collector being an open top cylinder (diameter about 5 in.) with vertical sides. Recommendations are made for the design of collector, classification of area, selection of site, length of sampling period, collection and analysis, and reporting and statistical interpretation of data. An appendix recommends a standard method of computation and examples are given.

256. Diesel Smoke Measurement. Hunter, H. C. (Pap. 630 to Soc. Automot. Engrs., Nov., 1955). This report describes the construction and operating principle of a continuous filtering-type, tape-recording smoke meter which has been tested and found superior in several respects to the CRC (photo-electric) smoke meter. The unit described appears to be satisfactory for the study of exhaust smoke from aspects of (1) the development of diesel engines and the improvement of combustion, (2) improvement of fuels, and (3) location of operating and maintenance faults. (D.S.I.R.).

257. Factors Affecting Diesel Smoke in Highway Operation. Howe, W. A. (Pap. 631 to Soc. Automotive Engrs. Nov., 1955). Results are presented of an investigation into the effect of certain fuel and engine characteristics on exhaust smoke from three automotive diesel engines. Smoke intensity curves show the effect of fuel and additive variables, road speed, and engine size. The relationships between smoke and (1) the amount of fuel and air delivered, (2) injection timing, (3) injector condition, (4) increased scavenging, and (5) load, are also represented graphically. It is concluded that exhaust smoke is caused more by engine malfunctioning than by fuel characteristics. (D.S.I.R.).

258. Injury to North-western Forest Trees by Sulphur Dioxide from Smelters. Scheffer, T. C. and Hedgcock, G. G. (U.S. Dept. Agric. Tech. Bull. 1117, 1955; Chem. Abstr., 1955, **49**, 14609). Evergreen, coniferous trees generally were more severely injured by smelter fumes than were deciduous trees, particularly when temperatures were above 40°F. Eighteen years after the initiation of sulphur dioxide abatement measures, there was no evidence of current injury to timber or plants. There was apparently no residual deleterious effect of sulphur accumulations in the soil. (D.S.I.R.).

THE DUTIES OF SANITARY INSPECTORS—*concluded*

ledge and contacts ensure that he is in the right place at the right time.

If in some cases the advice required would necessitate a prolonged and detailed investigation of highly technical points in connection with furnaces or boiler plant, there exists for that very purpose the National Industrial Fuel Efficiency Service, which charges an appropriate fee, and it would be wrong for an inspector of a local authority to concern himself with work of that nature. With regard to factories scheduled under the Alkali Acts, these are the direct concern of the Ministry's inspectors and not a responsibility of local authorities; nevertheless, when a nuisance arises from such works it is usual for the complaints to pour into the town hall rather than London, and the sanitary inspector is the first to know about it. Close co-operation between the Ministry's inspectors and the local sanitary inspectors is therefore essential.

In most large towns one or more of the sanitary inspectors will hold special qualifications with regard to smoke abatement and the number of inspectors so qualified is sure to increase rapidly now that the importance of such work has been officially recognized.



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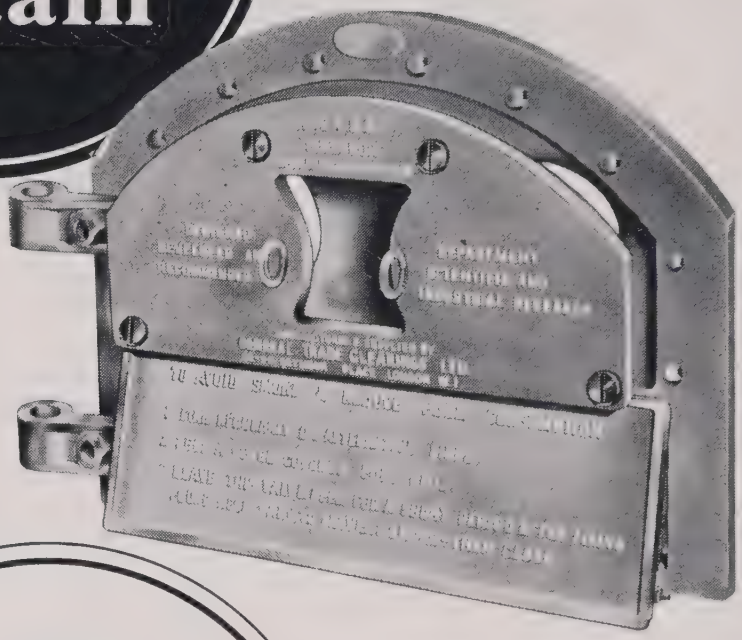


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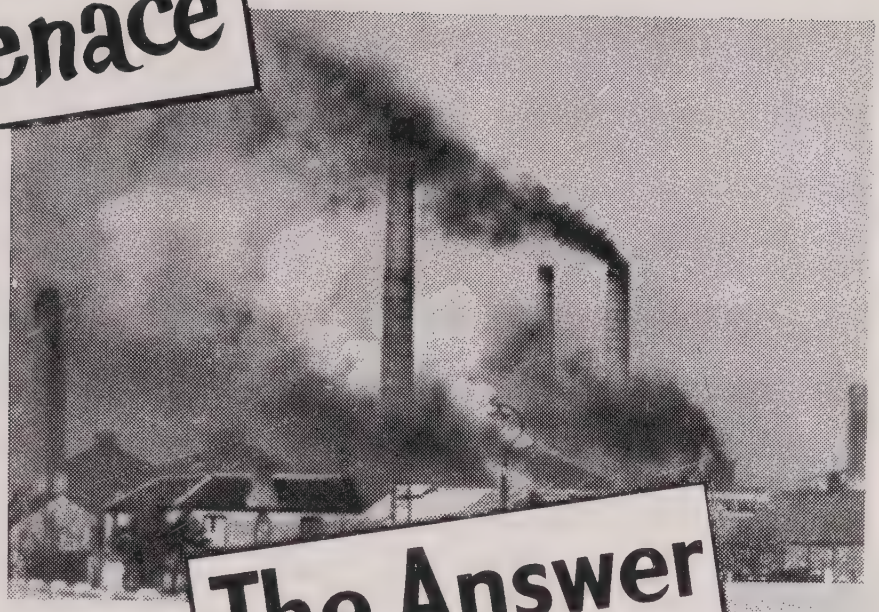
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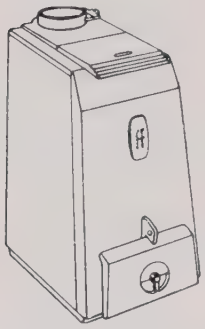
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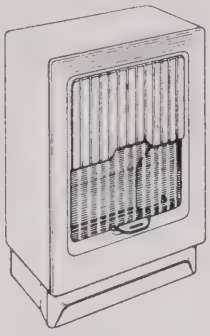
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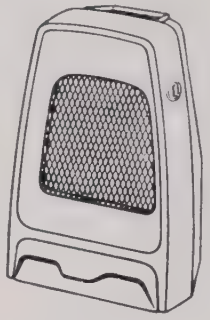
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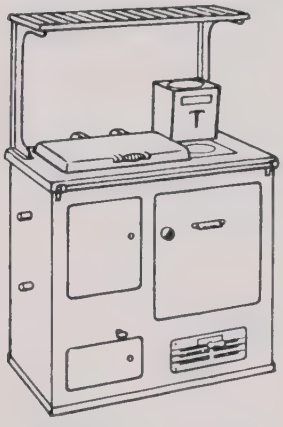
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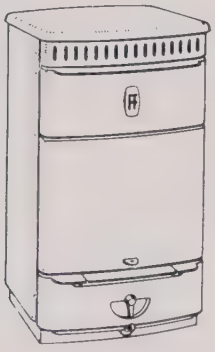
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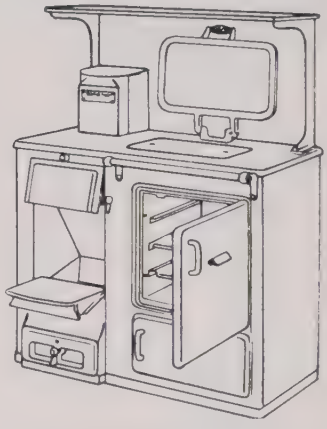
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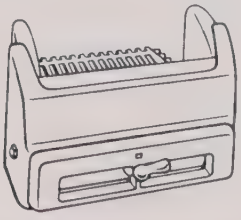
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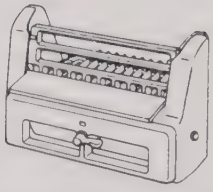
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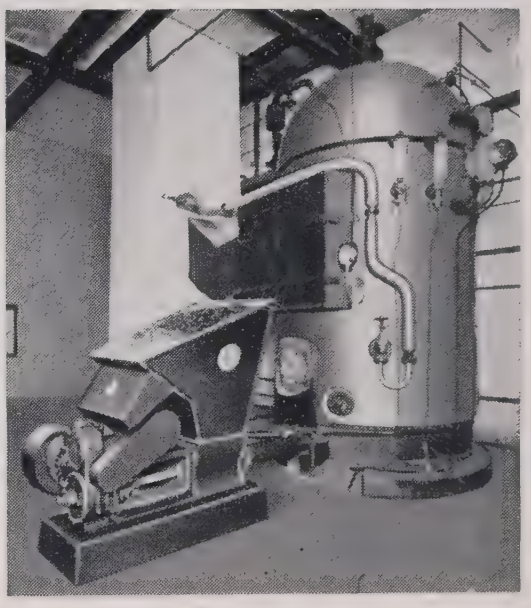
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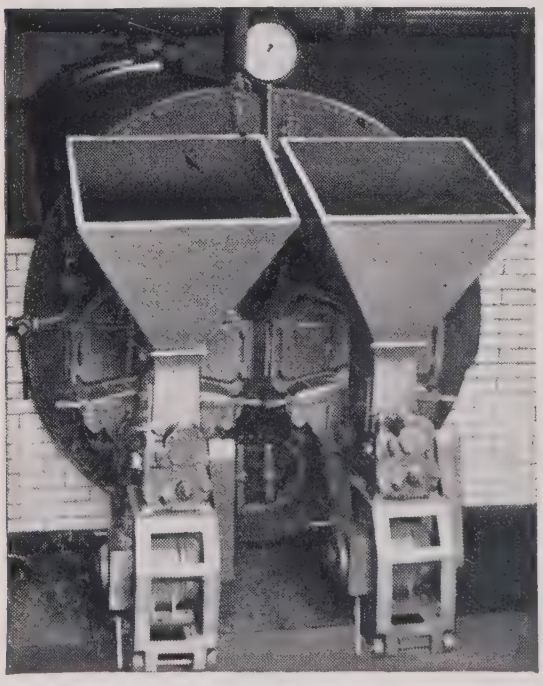
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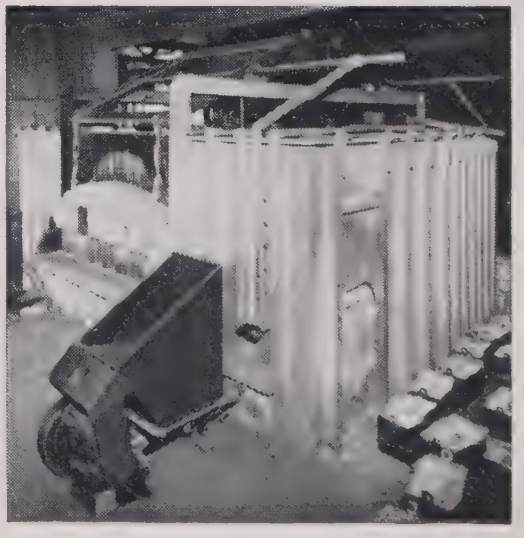
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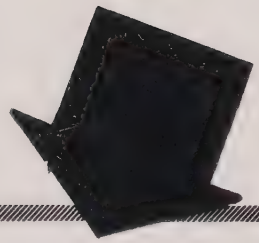
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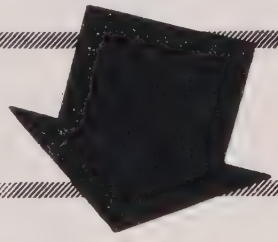
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2 What are its applications?
3 How efficient is it?
4 What does it do to the material?
5 What capacity can be dealt with?
6 How much space is needed?
7 How reliable is it?
8 How much does it cost?

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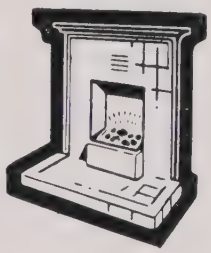
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SOLID SMOKELESS FUELS

The Solid Smokeless Fuels Federation

is a group of organisations responsible for practically the total production of solid smokeless fuels in Great Britain, amounting to 38,500,000 tons per annum. One of the main objects of the Federation is to ensure that solid smokeless fuels are used as efficiently as possible. The combined technical and scientific resources of the Federation, in association with appliance makers, are continually employed in developing high efficiency equipment both for the home and for industry.



The advantages of Solid Smokeless Fuels

Solid smokeless fuels give a *higher* proportion of *radiant* heat than household coal. Consequently you get more useful heat from approved domestic appliances at a *lower* cost for fuel.

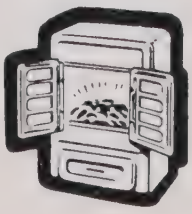
Appliances designed for solid smokeless fuels provide easy and accurate control of the rate of burning and heat output. This makes them extremely economical to run, and capable of long burning periods and overnight banking, thus saving work and attention.

Solid smokeless fuels are graded in a wide range of sizes and in a variety of types to ensure satisfactory performance in all domestic appliances.

Modern solid smokeless fuel appliances usually incorporate a built-in gas burner or gas poker. Lighting up is therefore simple, clean and convenient. No wood or paper is required.

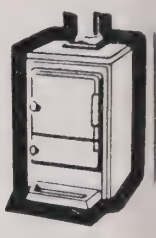
These fuels are smokeless and sootless. They save dirt and work in the home and help to keep house furnishings and paintwork clean.

Solid smokeless fuels are conducive to better atmospheric conditions and improved standards of health.



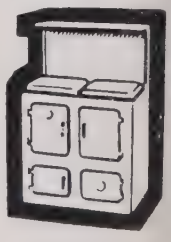
Which are the Solid Smokeless Fuels?

They comprise chiefly (1) the natural smokeless fuels, Welsh Anthracite and Dry Steam Coals, and (2) the manufactured smokeless fuels, Gas Coke, Hard Coke, Low Temperature Coke (''Coalite'' and Rexco) and Carbonised Ovoids. The natural fuels are obtained from underground coal seams. Both are dense fuels with a low ash content providing highly desirable long-burning properties. The manufactured fuels result from the carbonisation of coal in retorts or ovens, whereby the smoke-producing substance present, known as its ''volatile content'', is converted into gas and tar, the source of valuable by-products for use in home and industry. Carbonised Ovoids are marketed under the trade name of ''Phurnacite''. They have a uniform shape, a low ash content and are very similar in burning properties to Anthracite.



Smokeless Zones

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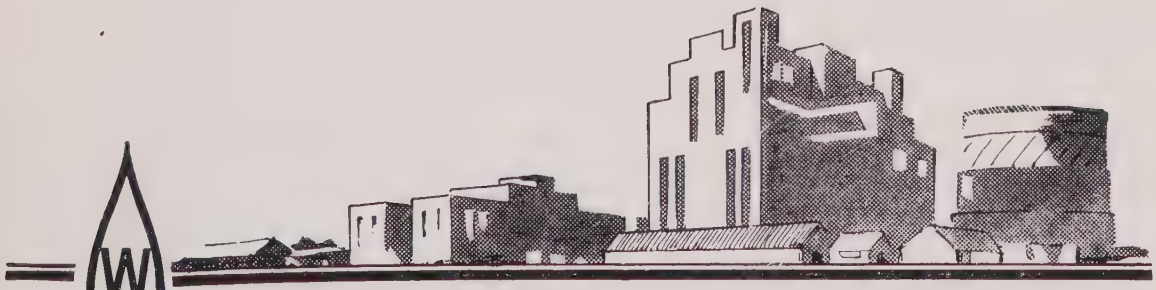
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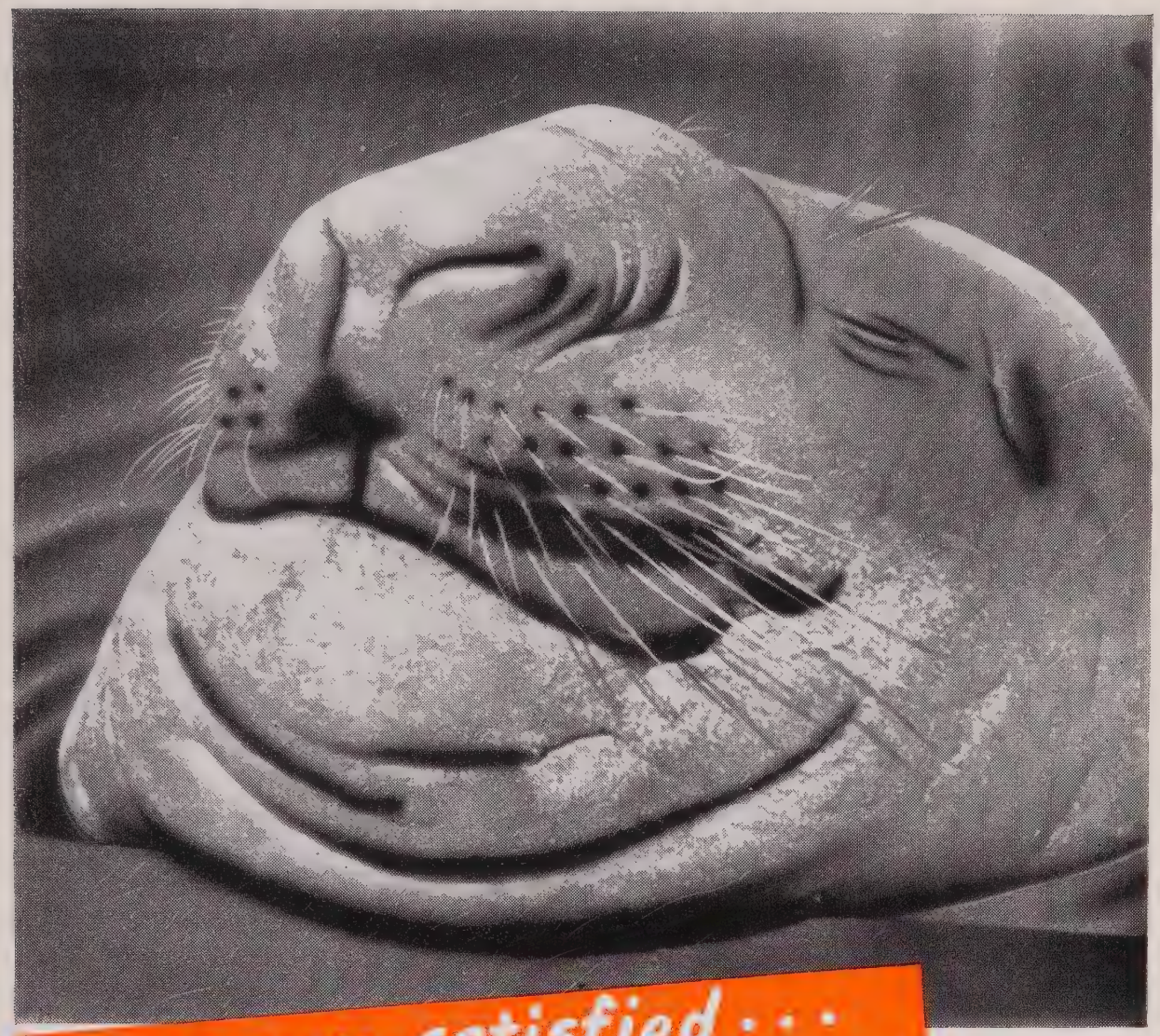
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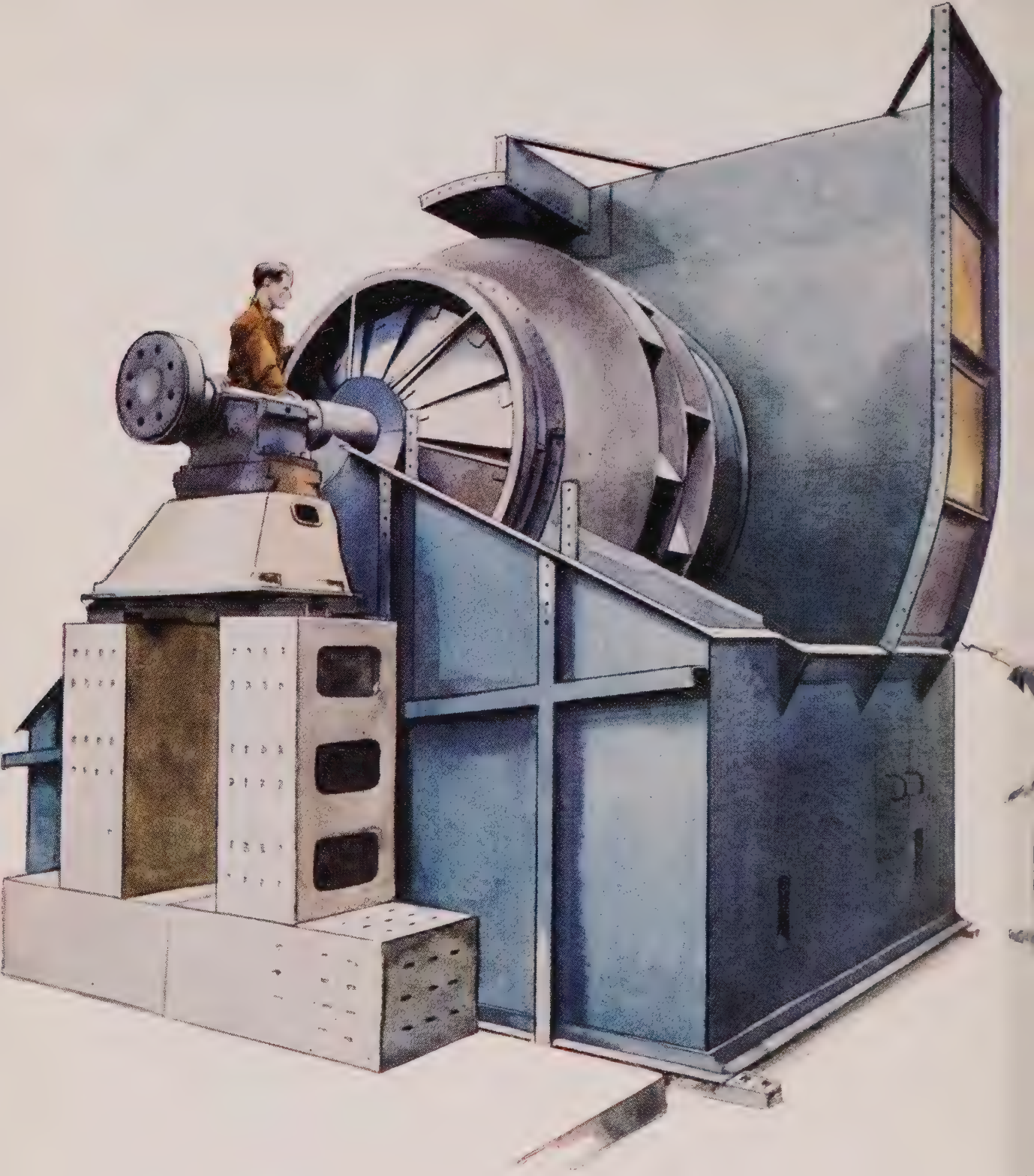
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